

Effectiveness of an internet-based pain self-management
intervention for individuals living with chronic pain



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DECLARATION

I hereby declare that I am the sole author of this thesis. All the published or unpublished work and ideas from others that I have been obtained and cited have been fully acknowledged in the text and included in the reference section. The current thesis has never been submitted in any institution for this degree or any other awards. This thesis is submitted in partial fulfilment of the requirements for the degree of the Professional Doctorate in Health Psychology at Queen Margaret University under the supervision of my first supervisor Dr Vivienne Chisholm and second supervision Dr Fox.

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Abstract

Background: Chronic pain is a prevalent healthcare problem which influences each aspect of an individual's life. A biopsychosocial approach is the dominant one to be taken in the understanding and treatment of chronic pain as not only physical but also psychological factors influence the pain experience. Multi-disciplinary interventions based on a biopsychosocial approach provide an effective treatment strategy for the management of chronic pain. However, the availability of these interventions is limited. Research indicates that internet-based self-management interventions can address this limitation. **Aim:** The aim of this study was to assess the effectiveness of an internet-based pain self-management intervention, for individuals with chronic pain that were recruited from various clinical settings. The intervention is a well-known pain self-management website known as the 'pain toolkit'. This is the first study that we are aware of which examines the effectiveness of the 'pain toolkit' intervention in a 'real-world' clinical context. It was hypothesised that the participants' fear of movement/(re)injury, pain-related anxiety, pain catastrophizing, pain (intensity and interference) and passive coping strategies (i.e. diverting attention, catastrophizing, praying/hoping) would decrease after engagement with the 'pain toolkit' website. Moreover, it was hypothesised that the participants' self-efficacy and active coping strategies (i.e. reinterpreting pain sensations, coping self-statements, ignoring pain sensations, increasing activity level, the ability to decrease pain and to control pain) would increase after engagement with the 'pain toolkit' website. Finally, it was hypothesised that the participants' readiness to engage in pain self-management would increase from the onset to the completion of the intervention. Specifically, engagement with the 'pain toolkit' intervention would facilitate participants' movement into a more advanced stage of pain self-management. **Methodology:** Self-report questionnaires, including: Pain Stage of Change Questionnaire (PSOCQ), Tampa Scale for Kinesiophobia (TSK), Pain Anxiety Symptoms Scale (PASS), Brief Pain Inventory (Short-Form: BPI), Pain Catastrophizing Scale (PCS), Pain Self-Efficacy Questionnaire (PSEQ) and Coping Strategies Questionnaire (CSQ) were completed by the participants - both before and after the intervention. Participants engaged with the intervention for 6 weeks. **Results:** Forty-eight chronic pain patients (27 females and 21 males) aged 22 to 77 completed the study. Participants showed significant reductions in pain related anxiety, fear of movement/(re)injury, and pain catastrophizing and there was significant improvement in their ability to decrease pain. **Conclusion:** These findings indicate that internet-based, pain self-management intervention, such as the 'pain toolkit' is an effective intervention on a variety of measures for individuals living with chronic pain.

Keywords chronic pain, internet-based intervention, pain self-management, multi-factorial intervention

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1. Introduction

Pain is an ubiquitous experience for humanity (Roditi & Robinson, 2011). It is a subjective, multidimensional and complex experience (Merskey & Bogduk, 1994; Roditi & Robinson, 2011). An illness or trauma can inflict pain but when the tissue damage is healed but pain is still experienced, then it is considered to be chronic (Kerns, Sellinger, & Goodin, 2011). Chronic pain is a significant issue due to: its prevalence, the economic cost and a lack of effective medical interventions (Gatchel & Epkel, 1999). Therefore, since some individuals have to live with unrelieved pain, as there is no cure for chronic pain, the improvement of self-management is important for a satisfactory quality of life, despite pain. Nowadays, psychological interventions focus on the enhancement of self-management (Keefe, Abernethy, & Campbell, 2005; Roditi & Robinson, 2011). The key element of self-management interventions is to facilitate individuals' involvement in the management of their condition (Newman, Steed, & Mulligan, 2004). Specifically, individuals who live with chronic pain are encouraged to acquire various skills and motivational techniques, which are important requirements for successful pain self-management (Ruehlman, Karoly, & Enders, 2012). Furthermore, in addition to knowledge, the enhancement of self-efficacy or confidence is a crucial element in order to accomplish the required changes for successful self-management (Edworthy, 2000; Foster et al., 2009). In the UK, the importance of pain self-management has been recognized and promoted through healthcare services (Smith & Elliott, 2005). Research evidence indicates that internet-based interventions are a very popular self-management option (El-Metwally, 2015). Moreover, the evidence for pain-management via the Internet for individuals living with chronic pain is promising

(Bender et al., 2011, Eccleston et al., 2014). Also, the advantage of this method of delivery is that participants can engage with the intervention at their own convenient time and pace (Macea, Gajos, Calil, & Fegni, 2010). Thus, the aim of the study presented in this thesis was to assess the effectiveness of an internet-based self-management intervention for chronic pain patients in a 'real-world' clinical context. The pain self-management intervention is a well-known website entitled 'pain toolkit'. This is the first study that we are aware of which assesses the effectiveness of the 'pain toolkit' website. Therefore, a comprehensive review of relevant and current empirical chronic pain research is presented in the following sections, in order to understand the theoretical and empirical premises which informed this study. Specifically, an overview of chronic pain - including its definition, assessment, epidemiology, factors that influence its prevalence and experience such as age, gender and cultural differences, are given in the subsequent sections.

The complex experience of chronic pain can be best understood from the biopsychosocial perspective (Roditi & Robinson, 2011). The theoretical importance of the biopsychosocial model is not only that it allows differentiation of the social, psychological and biological aspects of the pain experience but also recognises the interaction between them (Derbyshire, 1999). Therefore, the paradigm shift from a biomedical to the biopsychosocial model of chronic pain is reviewed in the following sections.

Evidence shows that emotional, cognitive and behavioural factors influence the development of chronic pain and contribute to its chronicity (Kerns et al., 2011). The cognitive and psychological factors which are positively related to psychological distress, physical disability and pain with the strongest empirical support are pain-

related anxiety, fear avoidance, catastrophizing, passive coping, low self-efficacy and readiness to engage with a self-management approach (Keefe, Rumble, Scipio, Giordano, & Perri, 2004; Kerns et al., 2011). Thus, these factors are reviewed in the following sections and have been used as indicators for assessment of the effectiveness of an internet-based self-management intervention.

Regarding the treatment of chronic pain, there has been a switch from the biomedical model to biopsychosocial treatments such as behavioural therapy, cognitive behavioural therapy, interventions based on the fear-avoidance model and acceptance and commitment therapy (Day, Thorn, & Burns, 2012). One of the main aims of psychological pain management intervention is to increase self-management instead of directly alleviating pain (Roditi & Robinson, 2011). As individuals living with chronic pain have to manage their pain, self-management is an essential component of efficacious pain therapies (Matthias, Miech, Myers, Sargent, & Bair, 2012). The theoretical distinctiveness of psychological therapies, theoretical background to the self-management approach and empirical support of psychological self-management interventions, in the context of chronic pain, are reviewed in the following sections. However, psychological pain-management interventions are not routinely provided to individuals with chronic pain (Keefe, Abernethy, & Campbell, 2005). Internet-based pain management interventions have the potential to overcome this deficit, or gap, in the provision of care for these patients (Keefe et al., 2005). Thus, empirical support for internet-based pain self-management interventions are explored in subsequent sections.

2. Literature Review

2.1. The background to Pain Experience

Pain, according to the International Association for the Study of Pain (IASP) is defined as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (Merskey & Bogduk, 1994, p.210). Pain can, however, occur without any tissue damage or pathophysiological cause (Eccleston & Crombez, 1999; Merskey & Bogduk, 1994) and is also a subjective and emotionally unpleasant experience (Merskey & Bogduk, 1994). Therefore, this definition captures all the various dimensions of pain experience (Derbyshire, 1999; Roditi & Robinson, 2011).

Pain is usually classified as nociceptive or neuropathic: Nociceptive pain being inflicted by actual non-neural tissue damage and neuropathic pain by “lesion or disease of the somatosensory nervous system” (IASP, 2012). Moreover, a pain experience can be acute or chronic (Merskey & Bogduk, 1994). Acute pain is inflicted by noxious stimuli, such as trauma or disease (Bonica, 1990). In this case, the role of pain could be considered a homeostatic response to aversive stimuli (Craig, 2003). Therefore, pain has a protective function; stimulating the individual to take action in order to avoid potential, or further, harm (Bonica, 1990; Ogden, 2007). Pain duration that exceeds further than tissue damage is considered to be chronic (Bonica, 1990; Kerns et al., 2011; Merskey & Bogduk, 1994). Persistent or chronic pain could be due to both malignant and non-malignant or benign conditions (Bonica, 1990; Merskey & Bogduk, 1994). Non-malignant pain that occurs for more than 3 months (for research purposes 6 months) is considered chronic (Merskey &

Bogduk, 1994). However, persistent pain does not serve the same protective function as acute pain (Bonica, 1990; Gilron, Jensen, & Dickeson, 2013).

2.2. Assessment of Chronic Pain

The recommended guidelines for clinicians regarding the assessment of chronic pain in a patient must include a comprehensive physical and biopsychosocial review (SIGN: Scottish Intercollegiate Guidelines Network, 2013). As pain is always a subjective experience, consideration of the patient's self-reported assessment of pain is essential (Loughlin, 2014). This type of assessment refers to the individual's subjective observation of his/her pain intensity (Ogden, 2007). For clinical and research purposes, some of the most common and valid methods of measuring pain intensity are the Numeric Rating Scale (NRC), the Visual Analogue Scale (VAS), the Faces Pain Scale-Revised (FPS-P) and the Verbal Rating Scale (VRS) (Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011). The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) recommends assessment of pain intensity through the Numeric Rating Scale (NRC) and the assessment of physical functioning in the context of pain through validated questionnaires, such as the 'Brief Pain Inventory', with the aim of enabling comparisons among research findings (Dworkin et al., 2010; SIGN, 2013). Moreover, as the pain experience is affected by psychological factors, the pain assessment must be accompanied by evaluation of psychological variables (Turk & Monarch, 2002). This is explained further in the section below, 'Biopsychosocial Model of Pain'.

2.3. Epidemiology of Chronic Pain

Pain is the most common reason for an individual to seek professional healthcare (Gallagher, 2004) and the prevalence of moderate to severe chronic pain significantly affecting the quality of life for European adults is around 19% (Breivik, Collett, Ventafridda, Cohen, & Gallacher, 2006). Chronic pain can also be accompanied by emotional distress and psychiatric conditions (Gatchel, 2004; Gatchel, Peng, Peters, Fuchs, & Turk, 2007; Tunks, Crook, & Weir, 2008): anxiety and depression are often comorbid conditions with chronic pain (Tunks et al., 2008; Von Korff et al., 2005). The prevalence of chronic pain in the Scottish population is around 18% (NHS Quality Improvement Scotland, 2008). More than 50 million people in the USA, and over 80% of medical consultations, occur for pain (Gatchel, 2004). Almost 8 million adults and children in UK suffer from chronic pain and, each year, 4 million GP appointments are for the alleviation of pain (NHS Quality Improvement Scotland, 2008). The findings derived from a large European survey indicate that the most common pain conditions are chronic back pain and chronic osteoarthritis pain (Muller-Schwefe, 2011). Chronic pain is an important health issue, due to: its high prevalence, the huge direct cost of utilisation of medical care, plus indirect costs such as diminished productivity (Gatchel, 2004). Kerns et al. (2011) indicated, based on research evidence, that the majority of people in Western societies experience some type of chronic pain during of their lifespan. Deeper understanding of factors that influence the prevalence and experience of pain, such as age, gender and cultural differences (described below), can facilitate better management of chronic pain (Hecke, Torrance, & Smith, 2013).

2.3.1. Factors that Influence the Prevalence and Experience of Pain

One important factor which influences pain experience is age. Chronic pain is a common health issue for children and adolescents (Perquin et. al., 2000). The results of a recent systematic review have indicated that the headache is the most common type of pain that has been studied in children and adolescents; with median prevalence up to 23% (King et al., 2011). However, the results from a community epidemiology study in the UK suggested that the prevalence of chronic pain in older adults is higher than in younger people (Elliot, Smith, Penny, Smith, & Chambers, 1999). Moreover, age influences the effective communication of pain experience among children younger than 3 years of age and adults over 85, and this difficulty leads to poor pain management (Boccio et al., 2014).

Cultural difference might be another factor that influences the experience of pain. Therefore, many researchers have investigated the influence of ethnic differences on the prevalence and impact of the pain experience (Edwards, Doleys, Fillingim, & Lowery, 2001; Edwards, Moric, Husfeldt, Buvanendran, & Ivankovich, 2005). Specifically, in line with previous clinical and experimental research evidence, Caucasian chronic pain patients demonstrate a lower level of pain-related disability and pain intensity (clinical pain), plus a higher level of ischemic pain tolerance (experimental pain), than African American patients (Edwards et al., 2001). However, many clinicians and researchers have been doubtful about the usefulness of investigating ethnic differences in pain research (Edwards, Fillingim, & Keefe, 2001). Pain is a universal experience and even though the perception and experience

of pain is influenced by cultural elements, the overall pain experience is unique and subjective for each individual (Free, 2002).

Furthermore, the evidence indicates that gender differences influence the pain experience (Keogh, 2006). Females report more pain than males (Fillingim, King, Ribeiro-Dasilva, Rahim-Williams, & Riley, 2009; Keogh, McCracken, & Eccleston 2005). Girls have a higher rate of chronic pain than boys (King et al., 2011; Perquin et al., 2000; Stanford, Chambers, Biesanz, & Chen, 2008). Psychosocial (e.g. gender roles) and biological (e.g. hormones) factors could differentiate the pain experience among genders (Fillingim et al., 2009; Keogh, 2006). Females also tend to utilise more coping strategies, such as social support, in dealing with their pain than males (Unruh, Ritchie, & Merskey, 1999). Moreover, gender could be an influencing factor in response to pain management interventions (Keogh et al., 2005; Pieh et al., 2012), as females benefit more than males (Pieh et al., 2012).

In summary, this overview of the research literature demonstrates that there are a number of influences on pain as pain experience is not only physical but also a negative, emotional, subjective experience. In particular, one way to conceptualise this complex and multidimensional human experience is by applying a biopsychosocial approach.

2.4. Historical Perspectives on the Pain Experience

In order to thoroughly explore the human experience of pain, from a biopsychosocial perspective, it is essential to understand historical perspectives of pain, and the way that these have influenced current research and practice.

2.4.1. Biomedical Approach to Pain

According to the traditional biomedical approach, the functions of mind and body are not interrelated (Gatchel et al., 2007). Pain is caused by tissue damage or disease; therefore the greater the degree of tissue damage, or severity of disease, the greater the pain intensity (Keefe et al., 2005). Pain is also considered to be a secondary symptom of, or reaction to, other prominent physical conditions and when the disease is 'cured', the pain will vanish (Turk & Monarch, 2002). In the absence of an organic cause, pain was considered to be psychogenic, due to psychological causes, which meant that the pain was not 'real' (Gatchel, 2004). However, physical pathology is not always proportional to the intensity of pain and disability (Keefe et al., 2005; Turk & Monarch, 2002). Conclusively, the biomedical approach fails to explain the complex experience of chronic pain (Turk & Monarch, 2002), due to it only taking biological variables into account and without any examination of the psychosocial or behavioural variables of illness (Engel, 1977). Therefore, taking into consideration only the physical aspects of the pain experience is not very helpful in order to understand and, eventually, to treat the complex experience of chronic pain. Nowadays, psychosocial factors are examined and shown to play an important role in the understanding and development of pain-management interventions. The Gate Control Theory, as described in detail below, was the first model to introduce the importance of other factors such as psychosocial ones which, in addition to physical factors, are implicated in the experience of chronic pain.

2.4.2. The Gate Control Theory of Pain

The Gate Control Theory (GCT) is the first model which tried to explain the pain experience by taking into account not only its physiological but also its psychological aspects (Melzack & Wall, 1996; Melzack & Wall, 1965). It takes into account the fact that pain can still be experienced after tissue healing, and that the pain location on the body is not always the same as the site of tissue damage. (Melzack & Wall, 1996). This suggests that the brain plays an essential role in the interpretation of pain signals, instead of being an inactive recipient of nociceptive stimulus, and is influenced by both sensory and psychological components (Day et al., 2012; Melzack & Wall, 1996; Melzack & Wall, 1965).

Following the development of the GCT, the pain experience could be explained as a multidimensional phenomenon, therefore it represents important progress in the area of pain management and research; facilitating a deeper understanding of pain mechanisms (Gatchel et al., 2007). By recognising the importance of psychological factors in pain experience, the GCT is the basis of a biopsychosocial approach to pain (Kerns et al., 2011). Moreover, the GCT has had a huge effect on the psychology of pain by highlighting the possible role of psychological treatments in pain management (Keefe et al., 2005).

2.4.3. Biopsychosocial Model of Pain

Engel (1977) underlined the necessity for broadening the biomedical model. The biopsychosocial model emphasizes both the 'illness' (where illness can be understood to be an interaction of psychosocial and biological variables) and 'disease' (Gatchel, 2004). 'Disease' is caused only by organic factors, whereas

‘illness’ includes the personal subjective interpretations of disease (Turk & Monarch, 2002). Understanding the differentiation between ‘disease’ and ‘illness’ is important in order to understand the chronic pain experience and this is analogous to the differentiation between ‘nociception’ and ‘pain’ (Turk & Monarch, 2002). ‘Nociception’ involves the sensory transmission of physical stimulation such as tissue damage to the brain, whereas ‘pain’ is the subjective interpretation of this transmission (Gatchel et al., 2007; Turk & Monarch, 2002). The subjective interpretation of pain experience might be affected by genetic predisposition, psychological factors, learning patterns and socio-cultural influences (Gatchel et al., 2007; Turk & Monarch, 2002).

To conclude, the biopsychosocial approach has been established as the most broadly accepted approach for the understanding and management of chronic pain (Gatchel et al., 2007). It is recognised that the pain experience is influenced by the interaction of psychological, physiological and social factors (Gatchel, 2004). The next section outlines some of the most important psychological factors which influence the adjustment to chronic pain. These factors are supported by a significant amount of evidence and accompanied by considerable clinical implications for the management of chronic pain (Keefe et al., 2004).

2.5. Psychological Factors which Influence Pain Experience

Chronic pain can be associated with dysfunction, however patients who consider their condition as controllable, catastrophise less and believe that they are not seriously disabled, have been shown to function better than those who consider and do the opposite (Jensen, Turner, Romano, & Karoly, 1991). According to Vlaeyen,

Kole-Snijders, Rotteveel, Ruesink, & Heuts, (1995) extensive evidence exists to indicate that pain and pain-related disability are not only affected by organic variables but also by psychosocial ones. Pain has a multifaceted nature (Day, Thorn, & Burns, 2012; Roditi & Robinson, 2011). Disregarding the psychological facet of the pain experience can obstruct recovery (Pincus & McCracken, 2013), as not only physical but also cognitive and emotional factors influence the experience of pain (Scascighini, Toma, Dober-Spielmann, & Sprott, 2008). Some of the factors, supported by the greatest amount of research evidence, that negatively influence pain, physical disability and psychological distress, as stated above, are pain catastrophizing, pain-related anxiety, fear avoidance and passive coping (Keefe et al., 2004; Kerns et al., 2011). On the other hand, some of the factors, supported by strongest amount of research evidence, that positively influence pain, physical disability and psychological distress are pain self-efficacy, the adoption of effective coping strategies and readiness to change (Keefe, 2004; Kerns et al., 2011). Moreover, for the management of chronic pain, these factors have significant clinical implications (Keefe et al., 2004) and have been targeted in pain-management interventions. Nowadays, psychological therapy is an integrated part of the multi-modal pain-management approach, which targets cognitive and affective factors alongside the physical aspects of the chronic pain experience (Roditi & Robinson, 2011). One major element of the psychological approach to chronic pain-management is the enhancement of self-management (Roditi & Robinson, 2011). An alternative means of delivering psychological interventions for individuals with chronic pain is via the Internet (Keefe et al., 2004; Pincus & McCracken, 2013). This method of delivery can increase accessibility to psychological interventions that are

usually provided in tertiary settings, to which many individuals do not have access due to cost and motility issues (Keefe et al., 2004). The aim of the current study was to assess the effectiveness of an internet-based pain self-management intervention in a real-world clinical context. There is no published study that we are aware of, which examines the effectiveness of this intervention. This is the first study aiming to examine the efficacy of the ‘pain toolkit’ website in a ‘real-world’ clinical context. Therefore, to achieve this aim it was necessary to take psychological variables, which previous research has shown to be important in this context, into consideration.

These factors have been integrated into theoretical models of pain, with the aim of providing an explanation of pain perception, desirable treatment outcomes and how some of these variables might influence the development and maintenance of persistent pain and disability (Linton & Shaw, 2011). Specifically, the cognitive-behavioural model of ‘Fear Avoidance (Vlaeyen, Kole-Snijders, Boeren & Eek, 1995; Vlaeyen et al., 1995; Vlaeyen & Linton, 2000) is the most common and accepted model, which explains how psychological factors can influence the pain experience (Pincus, Smeets, Simmonds, & Sullivan, 2010).

In the following section the ‘fear-avoidance’ (FA) model and the empirical support for the variables (fear of movement/(re)injury, pain related anxiety and fear, pain catastrophizing, self-efficacy and coping strategies toward pain) which influence pain experience are reviewed. Moreover, it is essential to mention that not only these but also other biopsychosocial variables influence the pain experience. However, it is out of the scope of this thesis to explore all the psychological factors that influence pain experience.

2.5.1. A Cognitive Behavioural Approach to Chronic Pain- The ‘Fear-Avoidance’ Model

Lethem, Slade, Troup & Bentley (1983) tried to explain how psychosocial factors influence both pain perception and various responses toward pain. They proposed the ‘fear-avoidance’ model, because the main contributing factor to the exaggeration of pain perception is the ‘fear of pain’. The two coping responses toward fear of pain are ‘confrontation’ (adaptive) and ‘avoidance’ (non-adaptive). The adaptive type of response leads to the elimination of fear over time, while the non-adaptive response leads to continuation and increase of fear, which eventually can develop into a phobic state. Specifically, fear of pain can lead to avoiding both social and physical activities which cause psychological and physical consequences. These consequences trigger pain experience to elicit avoidant behaviour since pain perception is exaggerated which eventually leads to further disability (Lethem et al., 1983).

Based on Lethem et al.’s (1983) work, a Cognitive-Behavioural Model of Fear-Avoidance (FA) was developed, in order to describe how the avoidance which is caused by the fear of movement/(re)injury possibly leads to pain related disability in individuals with musculoskeletal pain conditions (Vlaeyen et al., 1995; Vlaeyen et al., 1995; Vlaeyen & Linton, 2000). The FA model suggests that pain which is aggravated during movement elicits either adaptive or maladaptive (e.g. catastrophizing) cognitions. Negative thinking such as catastrophizing about the potential harmful effects of pain (re/injury) is associated with pain-related fear. Thus, in the fearful and anxious individual, more movement leads to more pain and this is perceived as dangerous. One behavioural response to fear of movement is ‘avoidance’. Therefore the fear of pain leads to an abrupt ending of previous habitual

activities which inflict pain, with the purpose of eliminating pain. Avoidance is elicited by the expectation of pain and not actually a response to pain. Avoiding activities over time leads to depression and actual physical disability, as the body loses its strength, due to lack of movement, which eventually eliminates the pain tolerance and aggravates pain symptoms (vicious cycle). On the other hand, adaptive cognitions lead to the adaptive behavioural response, 'confrontation'. When appraisal of pain is interpreted as a non-threatening stimulus, patients might maintain their daily activities which are associated with active coping responses toward pain and eventually help the patient to recover. Overall, the fear of movement/(re)injury is strongly related with the development of pain-related disability (Vlaeyen et al., 1995; Vlaeyen et al., 1995; Vlaeyen & Linton, 2000). Cross-sectional studies across various chronic conditions indicate that fear of movement/(re)injury as measured by Tampa Scale of Kinesiophobia (TSK; Miller, Kori, & Todd, 1991; Vlaeyen, Kole-Snijders, Boeren, & Eek, 1995), is associated with pain-related disability and provides further support for the FA model of chronic pain (e.g. Cook, Brawer, & Vowles, 2006; Crombez, Vlaeyen, Heuts, & Lysens, 1999; Gheldof et al., 2006). However, the evidence is restricted regarding the FA model, because it is derived from cross-sectional and prospective cohort studies (Vangronsveld, Peter, Goossens, & Vlaeyen, 2009) and the direction of causality among variables is difficult to clarify.

Moreover, physical complaints are predicted by pain related-anxiety as measured by Pain Anxiety Symptoms Scale (PASS; McCracken, Zayfert, & Gross, 1992) (McCracken, Faber, & Janeck, 1998). High levels of pain related-anxiety for individuals with lower back pain (for example) are associated with a bigger

constraint interns of range of motion (McCracken, Gross, Sorg, & Edmands, 1993). Pain related-anxiety and fear are strong predictors of pain interference and disability (McCracken et al., 1992). In addition, McCracken and Gross (1993) examined the different types of pain-related fear and anxiety as measured by Pain Anxiety Symptoms Scale (PASS; McCracken et al., 1992) and their association with the utilisation of certain pain coping techniques as measure by Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983). They found that physiological anxiety (e.g. 'I find difficult to calm my body after periods of pain') is associated with increased utilisation of coping techniques in general. Cognitive anxiety (e.g. 'I can't think straight when I am in pain') is associated with less engagement with cognitive coping techniques. Also escape and avoidance anxiety (e.g. 'as soon as pain comes on I take medication to reduce it') is associated with increased engagement with overt pain coping behaviours. Moreover, the majority of the empirical support regarding pain-related anxiety is derived from individuals living with musculoskeletal pain (Keefe et al., 2004). Therefore, further studies are essential to examine the impact of pain-related anxiety in different types of individuals living with chronic pain, e.g. patients with cancer or rheumatoid arthritis (Keefe et al., 2004).

The differentiation between pain-related anxiety and fear is difficult to define, especially in a clinical pain context, and for this reason these terms are usually used interchangeably (Leeuw et al., 2007). For chronic pain patients, self-administered questionnaires are important tools for assessment of pain related fear information (Roelofs et al., 2004). The Tampa Scale of Kinesiophobia (TSK; Miller et al., 1991; Vlaeyen et al., 1995) for measuring fear of movement and (re)/injury and the Pain

Anxiety Symptoms Scale (PASS; McCracken et al., 1992) for measuring more general anxiety and fear of pain are valid and reliable self-report questionnaires (Crombez et al., 1999; Houben, Leeuw, Vlaeyen, Goubert, & Picavet, 2005; Roelofs et al., 2004) which are considered to be the best available questionnaires to assess these psychological constructs (Lundberg, Grimby-Ekman, Verbunt, & Simmonds, 2011). When the time and effort is considered to be restricted for the individuals, a short form of PASS (McCracken & Dhingra, 2002) is also available (Roelofs et al., 2004). The TSK and short form of PASS have been utilised for the purposes of the current study.

The FA model is one of the most established and significant for explaining the role of psychological variables in pain experience (Linton & Shaw, 2011; Pincus et al., 2010). Research has demonstrated that there is a strong positive association between pain-related fear and disability (for meta-analysis see Zale, Lange, Fields, & Ditre, 2013). Moreover, Lohnber (2007) reviewed the literature and supported the argument that the FA model provides a useful framework for development of therapeutic interventions, with the aim of decreasing the fear of pain and subsequently, pain-related disability. An approach that includes catastrophizing, fear of movement/(re)injury beliefs and depression can increase the patient's function and help with the prevention of pain related-disability (Boersma & Linton, 2006). Furthermore, Leeuw et al. (2007) reviewed the recent research evidence for the fear-avoidance model and they supported cognitive-behavioural or educational interventions which aim to reduce pain-related fear/avoidance and catastrophizing, which seems to be an important target for effective treatments.

Therefore, both fear of movement/(re)injury and pain-related anxiety have been utilised as important indicators in order to examine whether internet-based pain self-management intervention has an effect on these factors. Moreover, evidence which claims to improve these factors is reviewed in the management of chronic pain and self-management approach sections.

2.5.2. Pain Catastrophizing

Another psychological variable that is important to explore in order to better understand the role of psychological factors in pain experience is catastrophizing. Catastrophizing is defined as “an exaggerated negative mental set brought to bear during painful experience” (Sullivan et al., 2001) Catastrophizing is comprised of the ‘rumination’, ‘magnification’ and ‘helplessness’ dimensions of pain experience (Sullivan, Bishop, & Pivik, 1995).

As explained in the FA model, the role of catastrophizing is important in pain experience and pain-related disability (Vlaeyen, et al., 1995; Vlaeyen, et al., 1995; Vlaeyen & Linton, 2000). High levels of catastrophizing as measured by Pain Catastrophizing Scale (PCS; Sullivan et al., 1995) in chronic pain patients is associated with more psychological distress, pain-related disability and pain intensity, compared to chronic pain patients with lower levels of catastrophizing (Severeijns, Vlaeyen, van den Hout, & Weber, 2001). Similarly, high levels of catastrophizing in individuals with multiple sclerosis is associated with lower psychological functioning and augmented pain intensity and interference (Osborne, Jensen, Ehde, Hanley, & Kraft, 2007). Moreover, individuals with high levels of catastrophizing report more pain intensity and emotional distress during the cold

pressor procedure than individuals with low levels of catastrophizing (Sullivan et al., 1995). Another study demonstrated that both catastrophizing and fear of movement/(re)injury as measured by Tampa Scale of Kinesiophobia (TSK; Miller et al., 1991; Vlaeyen et al., 1995) in patients with acute whiplash injury are positively associated with disability and pain (Vangronsveld, Peters, Goossens, & Vlaeyen, 2009). Similarly, both catastrophizing and fear of movement/(re)injury are predictors of depression and disability (Nieto, Miro, & Huguet, 2009). In line with previous studies, pain catastrophizing is associated with higher levels of depression (Turner, Jensen, & Romano, 2000). In summary, a large amount of evidence consistently indicates that catastrophizing is associated with an augmented pain experience and it is one of the most important predictors of the pain experience (Sullivan et al., 2001). However, the majority of the research evidence on catastrophizing is derived from cross-sectional and correlational studies, in which the direction of causality between catastrophizing and pain adjustment is difficult to determine (Keefe et al., 2004). Turner et al. (2000) underline the necessity of teaching chronic pain sufferers to recognise and eliminate catastrophizing as a component of therapeutic interventions. Catastrophizing is a target for psychological interventions because it negatively influences the functioning of individuals living with chronic pain (Sturgeon, 2014).

Catastrophizing also influences various pain related behaviours (Keefe et al., 2004). For instance, patients with a high level of catastrophizing before surgery had longer hospitalisation after total knee arthroplasty (Witvrouw et al., 2009). Moreover, a higher level of catastrophizing as measured by the Pain Catastrophizing Scale (PCS; Sullivan et al., 1995) before surgery is associated with higher post-surgical pain (Pavlin, Sullivan, Frend, & Roesen, 2005). A high level of catastrophizing in patients

with chronic pain is further associated with a high risk of opioid misuse (Martel, Wasan, Jamison, & Edwards, 2013). In summary, these findings indicate that catastrophizing is associated with a variety of pain related behaviours such as the use of analgesics and medical care utilisation.

Catastrophizing can be measured by means of self-report tools (Sullivan et al 2001). Two of the most widely used and validated tools are the catastrophizing subscale of the Coping Strategies questionnaire (CSQ; Rosenstiel & Keefe, 1983) which measures a single dimension of catastrophizing (intolerable and terrible pain thoughts) Turner, Jensen, Warm, & Cardenas, 2002), and the Pain Catastrophizing Scale (PCS; Sullivan, 1995) which captures other dimensions of catastrophizing such as rumination, magnification and helplessness (Arnow et al., 2011). It has been proposed that coping and catastrophizing can be considered as two independent, distinct variables. Specifically, catastrophizing can be considered, to be an appraisal, a distress response, or an extreme worry about pain - rather than a coping strategy toward pain (Eccleston, 2001; McCracken & Eccleston, 2003; McCracken & Gross, 1993; Thorn, Rich, Boothby, 1999; Turner et al., 2000). Research which support this differentiation is reviewed in the section 'Pain Coping Strategies'. The PCS is considered to be the standard psychometric tool of assessing pain catastrophizing (Leung, 2012) for this reason it has been utilised in the current study.

Taking the research evidence together, it is reasonable to speculate that catastrophizing is important in understanding pain experience. Therefore, it is used as an important variable in order to examine whether internet-based pain self-management intervention has any effect. Evidence for the effectiveness of pain

interventions, in changing catastrophizing is reviewed in the sections 'Management of Chronic Pain' and 'Self-Management of Chronic Pain'.

2.5.3. Pain Self-Efficacy

Pain self-efficacy is another important psychological factor to explore, as it influences pain experience and adjustment. Self-efficacy refers to an individual's beliefs about his/her ability to engage in an action, in order to achieve an aspired outcome (Bandura, 1997). In the context of pain, self-efficacy beliefs refer to the confidence in one's ability to manage pain (e.g. belief that he/she can successfully utilise strategies in order to cope with pain or individuals' confidence in their ability to perform certain task e.g. daily activities) (Nicholas, 2007; Turner, Ersek, & Kemp, 2005). Individuals with chronic pain and low levels of pain self-efficacy feel that their pain is unmanageable (Linton & Shaw, 2011). Self-efficacy is essential variable in self-management interventions, which aim to increase self-efficacy in order to improve self-management which eventually may affect health (Foster, Taylor, Eldridge, Ramsay, & Griffiths, 2009).

Higher levels of self-efficacy are associated with better psychological functioning for individuals living with chronic pain (Jensen et al., 1991). Chronic pain patients with high levels of self-efficacy are more likely to have lower levels of pain, physical disability, anxiety and depression (Beckham, Rice, Talton, Helms, & Young, 1994). Moreover, a low level of self-efficacy in individuals with rheumatoid arthritis is associated with more pain, physical impairment, fatigue, anxiety and depression and less acceptance of their medical condition (Barlow, Cullen & Rowe, 2002). Skidmore et al. (2015) found that changes in depression were related to changes in

pain, due to changes that occur in pain self-efficacy - as measured by Pain Self-Efficacy questionnaire (PSEQ; Nicholas 2007) in patients with chronic pain. Specifically, pain severity, in terms of affective experience of pain, can actually diminish as a consequence of pain self-efficacy. Therefore, pain self-efficacy is an important variable for managing and predicting depressive symptoms of pain severity. For that reason, pain self-efficacy should be included in the design and implementation of pain-management interventions for chronic pain patients (Skidmore et al., 2015).

According to Borsbo, Gerdle, & Peolsson, (2010), self-efficacy is also negatively associated with pain (duration, intensity and spread) and positively associated with general health and quality of life. Self-efficacy acts as a positive contributor to general health, quality of life and eliminating disability in individuals living with chronic pain. Authors also suggest that, rather than try to control pain, it is important to enhance self-efficacy in order to eliminate its consequences (Borsbo, et al., 2010).

Furthermore, pain self-efficacy is associated with pain coping and disability. According to Turner et al. (2005) higher levels of self-efficacy are associated with lower levels of depression and pain-related disability, and the use of more active coping strategies. Specifically, a high level of self-efficacy in older adults with chronic pain is more likely to engage with more active coping strategies toward pain, such as pacing, use coping self-statements and exercise regardless the level of pain intensity. The causal relationship between outcomes and self-efficacy is difficult to determine, due to the nature of cross-sectional study design. Moreover, these researchers noted no significant association between pain intensity and levels of self-efficacy. Therefore, this indicates that less pain does not lead to higher levels of self-

efficacy (ability and confidence to control pain) or the opposite pattern (Turner et al., 2005). A recent systematic review examined the prognostic value of coping strategies and self-efficacy for individuals with osteoarthritis. It noted that both self-efficacy and active coping are predictive of an improved mood. Self-efficacy has also been shown to be predictive of decreased disability, while passive coping has been shown to be predictive of increased disability (Benyon, Hill, Zadurian, & Mallen, 2010).

Denison, Asenlof, and Lindberg (2004) found that self-efficacy was negatively associated with disability, catastrophizing and fear of movement/(re)injury- as measured by the Tampa Scale for Kinesiophobia (TSK; Miller et al., 1991; Vlaeyen et al., 1995). Moreover, self-efficacy was observed as being a better predictor of disability than pain intensity, catastrophizing or fear of movement/(re)injury, in a primary healthcare sample of chronic pain patients (Denison et al., 2004). Similarly, Woby, Urmston and Watson (2007) found that self-efficacy was more strongly associated with disability and pain, rather than pain-related fear (i.e. catastrophizing and fear of movement/(re)injury) in chronic lower back pain patients, with a high score in pain-related fear. Moreover, they found that self-efficacy mediates the association between disability and pain-related fear, as well as the relation between pain intensity and pain-related fear. Overall, this research demonstrates that pain self-efficacy is an important factor which influences pain experience.

Pain self-efficacy is usually assessed by self-report questionnaires (Keefe et al., 2004; Miles, Pincus, Carnes, Taylor, & Underwood, 2011). Two of the most common self-efficacy questionnaires are the Arthritis Self-efficacy Scale (ASES; Lorig, et al., 1989) which has been used for many studies of patients with rheumatic

disorders (Miles et al., 2011; Strahl, Kleinknecht, & Dinnel, 2000) and the Pain Self-Efficacy questionnaire (PSEQ; Nicholas, 1989, Nicholas, 2007). The PSEQ is a validated tool which is frequently used to assess changes in pain self-efficacy in numerous cognitive behavioural research interventions (Nicholas, 2007). Thus, it has been utilised for the purpose of this study.

Evidence suggests that self-efficacy is an important factor in understanding the pain experience (Keefe et al., 2004). For this reason, it is used in the study undertaken here, as an important indicator to examine whether the internet-based pain self-management intervention can have an effect on it. The ways that self-efficacy can be enhanced are presented in the ‘Self-Management of Chronic Pain’ section. Moreover, research evidence for the effectiveness of pain-management interventions in terms of changing pain self-efficacy are reviewed in subsequent sections.

2.5.4. Pain Coping Strategies

Coping is defined as a ‘constantly changing cognitive and behavioural effort to manage specific external and/or internal demands that are appraised as exceeding the resources of the person’ (Lazarus & Folkman, 1984, p. 141). In the context of pain, coping strategies are referred to as the individual’s efforts to deal with pain (Rosenstiel & Keefe, 1983). Pain coping includes both behavioural efforts, such as patients’ activities in relation to their pain (e.g. medication use), and cognitive efforts, such as patients’ intellectual effort (e.g. ignoring pain, perseverance of pain) (Phillips, Carroll, Voaklander, Gross, & Beach, 2012). Coping covers all aspects of patients’ functioning; including emotional, physiological, behavioural and cognitive features (Peres & Lucchetti, 2010). In the last few decades, treatment and research

have been focused on coping as being an important contributor in the adjustment to chronic pain (McCracken & Eccleston, 2003).

Various types of coping classifications have been proposed (Peres & Lucchetti, 2010). One type of such classification is differentiation between ‘problem-focus’ (involving efforts to control the stressful stimulus) and ‘emotional-focus’ (involving emotional responses to the stressful stimulus) (Lazarus & Folkman, 1984). Coping can also be categorised into adaptive and maladaptive strategies. Specifically, a patient’s attempts to control or to function despite his/her pain are considered adaptive or active coping strategies (Brown & Nicassio, 1987). On the other hand, when the patient allows pain to negatively influence various aspects of his/her life or abdicates control of his/her pain to others, these are considered maladaptive or passive coping strategies (Brown & Nicassio, 1987).

Individuals with chronic pain who engage with coping strategies such as ‘coping self-statements’ (e.g. ‘I tell myself that I can overcome pain’), ‘reinterpreting pain sensation’ (e.g. ‘I imagine the pain is outside of my body’) and ‘ignoring pain sensation’ (e.g. ‘I don’t pay any attention to it’) have an active coping approach toward pain (Rosenstiel & Keefe, 1983). Conversely, a high degree of utilisation of ‘catastrophizing’ and a low utilisation of ‘increasing behavioural activity level’ entail a passive approach towards pain which is also associated with a low rating of ability to control and decrease pain. Individuals with chronic pain who used ‘praying/hoping’ and ‘diverting attention’ (e.g. ‘I think of people I enjoy doing things with’) strategies show that coping with pain depends on external factors (Rosenstiel & Keefe, 1983).

The utilisation of certain coping strategies is related to the adjustment to chronic pain (Jensen et al., 1991; Rosenstiel & Keefe, 1983). Phillips et al. (2012) found that utilisation of 'increasing pain behaviours', 'ignoring pain' and 'coping self-statements' (active coping strategies) - as measured by Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983) are negatively associated with depression. On the other hand, the utilisation of 'catastrophizing' (passive coping strategy) is positively associated with depression. Additionally, increased pain level is positively associated with increased utilisation of 'praying/hoping' coping strategy in occupationally injured workers with chronic pain. McCracken and Eccleston (2003) found that 'praying/hoping' and 'diverting attention' are consistently related to poor health functioning and more pain. In another study, chronic pain patients who view outcomes as being controlled by external factors (e.g. luck or fate) exhibit more psychological distress (Crisson & Keefe, 1988). In summary, evidence demonstrates that the engagement with 'catastrophizing', 'diverting attention' and 'praying/hoping' coping strategies are associated with high levels of psychological distress and pain.

Blyth, March, Nicholas and Cousins (2005) found that the utilisation of passive coping strategies was associated with an increased possibility of having a high level of pain-related disability and more health-related visits regarding pain, whereas active strategies were associated with lower levels of pain-related disability and utilisation of healthcare. Carroll, Ferrari, Cassidy and Cote (2014) have further indicated that the adoption of passive coping strategies at the onset of whiplash-associated disorders (at 6 weeks) is associated with slower recovery from the resulting neck pain and disability. Moreover, according to Brown and Nicassion

(1987), patients' engagement with active coping strategies is related to greater self-efficacy and health locus of control and lower functional impairment, helplessness, depression and pain while the opposite pattern of variables is related to engagement with passive coping strategies. Conclusively, engagement with certain coping strategies is associated with the quality of an individuals' adjustment to pain.

In the context of the FA model, as explained above, the role of avoidance is crucial to pain-related disability (Vlaeyen et al., 1995; Vlaeyen et al., 1995; Vlaeyen & Linton, 2000). Avoidance behaviour comprises avoidance of social interactions, physical activity and movements, and incorporates passive coping techniques like rest; it is considered to be a maladaptive response toward pain (Samwel, Evers, Crul, & Kraaimaat, 2006). Strahl et al. (2000), in line with other researchers indicated that passive coping was inversely associated with optimal physical function, whereas active coping was directly related to increased social interaction. Furthermore, Samwel et al. (2006) indicate that disability could be predicted by passive behavioural coping strategy (e.g. avoidance of activity).

As was discussed in the 'catastrophizing' section, coping and catastrophizing can be considered as distinct variables. Evidence from research supports this differentiation: Bishop and Warr (2003) for instance, found that a high level of catastrophizing - as measured by Pain Catastrophizing Scale (PCS; Sullivan et al., 1995) was associated with anxiety and depression. Passive coping, however, was associated with more disability, whereas active coping was associated with less disability. These results are consistent with research such as that of Turner et al. (2000) which indicated that coping was independently associated with physical disability and catastrophizing was independently associated with depression. In summary, catastrophizing and coping

uniquely contribute in domains of psychological and physical adjustment to chronic pain and should be targeted in psychological interventions (Bishop & Warr, 2003; Nieto, Miro, Huguet, & Saldana, 2011). Thus, based on this conceptual differentiation, the current study has considered coping and catastrophizing as two distinct variables, and they have been measured by different questionnaires.

Furthermore, there is a relationship between coping and self-efficacy. Specifically, according to Keefe et al. (1997), engagement with active coping strategies ('coping self-statement' and 'ignoring pain sensation', as measured by the CSQ) is related to higher levels of self-efficacy and lower pain ratings. Patients with passive coping strategies ('praying/hoping') have low self-efficacy during their performance of daily tasks. Educational and/or coping skills interventions which aim to enhance active coping strategies such as 'coping self-statements' and 'ignoring pain sensations' and eliminate maladaptive coping strategies, could facilitate the enhancement of self-efficacy, reduce pain and improve psychological and physical functioning (Keefe et al., 1997). Also rheumatoid arthritis patients with a high level of self-efficacy are more confident in managing their condition, and are, therefore, likely to utilise emotional-focused coping (Lefebvre et al., 1999). Moreover, patients with a high level of self-efficacy for pain, have higher ratings for their ability to decrease and control their pain (Lefebvre et al., 1999). There is also a relationship between coping and perceptions of control over pain; as higher scores in active coping strategies, as measured by Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983), such as 'reinterpreting pain sensation' and 'coping self-statement' (regardless of pain severity) are associated with more perceived control over pain for various types of chronic pain patients (Haythornthwaite, Menefee, Heinberg, & Clark, 1998).

Therefore, the results that highlight the utilisation of ‘coping self-statements’ and ‘reinterpreting pain sensation’ in cognitive-behavioural interventions can increase self-efficacy and perceived control over pain (Haythornthwaite et al., 1998).

The Coping Strategies Questionnaire (CSQ, Rosenstiel & Keefe, 1983) is the most widely used tools for chronic pain patients to measure both behavioural and cognitive coping strategies toward pain (Crisson & Keefe, 1988; Jensen et al., 1991; Tan, Jensen, Robinson-Whelen, Thornby, & Monga, 2001); for these reasons it has been used in the current study.

In light of research evidence demonstrating the importance of coping strategies in pain management, they have been used as indicators in the current study. The utilisation of effective coping strategies is used as an index of the intervention efficacy. Internet-based pain self-management interventions have often targeted coping strategies; demonstrating their importance for optimal pain management. These studies are reviewed in the following section. In summary, some of the most important psychological variables (such as fear of movement/(re)injury, self-efficacy, catastrophizing, coping and pain related anxiety and fear, have been used in order to examine whether engagement with the intervention can affect these variables. In this way the effectiveness of intervention is assessed.

2.6. Management of Chronic Pain

So far it has been argued that it is important to explore the human experience of pain from a biopsychosocial perspective. Specifically, to examine a variety psychological indices that have been reported to be associated with chronic pain (e.g. fear of movement/(re)injury, pain related anxiety, catastrophizing, self-efficacy and pain

coping strategies). However, it is also important to explore the reduction of psychological variables that negatively influence the experience of pain and the improvements of psychological variables that positively influence it. There is a vast amount of literature on the treatment of chronic pain. In the following sections the dominant treatment options that are available for the management of chronic pain are reviewed.

2.6.1 Medical Approach to the Management of Chronic Pain

Management of chronic pain is a very demanding and complicated issue for health care professionals (Gallgher, 2004). The first line of treatment for chronic pain is offered in primary care (Stannard & Johnson, 2003). Currently available pharmacological therapies for chronic pain includes opioids (see review Noble et al., 2010), non-steroidal anti-inflammatory drugs (NSAID), antidepressants (e.g. tricyclic, serotonin norepinephrine re-uptake inhibitors), and anticonvulsant analgesics (Ashburn & Staats, 1999; Finnerup, Sindrup, & Jensen, 2010; Gilron, 2013; SIGN, 2013). A combination of analgesics is usually administered for various types of chronic pain (Finnerup et al., 2010; Gore, Sadosky, Stacey, Tai, & Leslie, 2012; SIGN, 2013), as the administration of one type of analgesic is usually ineffective (Gilron et al., 2013). However, GPs in the UK believe that the majority of the patients remain untreated due to the serious side effects and ineffectiveness of available treatments (Stannard & Johnson, 2003). Some of the harmful side effects of pain analgesics are: dizziness, addiction, constipation, memory issues and sedation (Breivik et al., 2006; Gilron et al., 2013).

A minority of patients are referred to secondary specialised pain clinics (Stannard & Johnson, 2003). In the UK, medical-based pain clinics provide oral pain relief medication and procedures such as injections (McCracken, 2005). Evidence regarding the efficacy of injections in the treatment of pain is not well established (McCracken, 2005; for review see, Nelemans, deBie, deVet, & Sturmans, 2001). Other medical interventions for the management of chronic pain include surgical procedures (for review see Chou et al., 2009), spinal cord stimulations (for review see Turner, Loeser, Deyo, & Sanders, 2004), transcutaneous electrical nerve stimulation (TENS) units (for review see Nnoaham & Kumbang, 2008) and nerve ablations (Kapural & Mekhail, 2001). The waiting time for admission to these clinics is quite lengthy- from around four to five months (Stannard & Johnson, 2003). However, medical interventions and analgesics are not always effective for the alleviation of chronic pain (McCracken, 2005; Turk, Audette, Levy, Mackey, & Stanos, 2010). Unsuccessful attempts by chronic pain patients to find relief for their pain make them feel helpless and frustrated (Gatchel & Epker, 1999).

2.6.2. Biopsychosocial Approach to the Management of Chronic Pain

The biopsychosocial approach is recognised as the common framework for the development of therapeutic interventions for chronic pain (Day et al., 2012; Gatchel et al., 2007). Thus, the biopsychosocial approach has turned the management of chronic pain into multi-disciplinary (where various professionals work independently for the same patient) or newly, into inter-disciplinary (where various professionals work together for the same patient) rehabilitation programmes (IPMPs) (Bosy, Etlin,

Corey et al., 2010; Morlion, Kempke, Luyten, Coppens, & Wambeke, 2011). Physicians, pharmacists, nurses, psychologists, counsellors, physiotherapists and occupational therapists collaboratively contribute to the development, execution/implementation and follow-up of treatment in multi-disciplinary rehabilitation pain programmes (Ashburn & Staats, 1999; Townsend, Bruce, Hooten, & Rome, 2006).

The main goals of interdisciplinary pain treatments are a) to facilitate patients return to productivity, b) to assist patients to take responsibility to self-managing their pain, c) to increase physical function, which eventually eliminates pain, d) to avoid medication and medication misuse, and e) to maintain all these therapeutic benefits (Aronoff & Feldman, 2000; Gatchel & Turk, 1999; Sanders, Harden, & Vicente, 2005; Townsend et al., 2006).

Principles of behavioural therapy (e.g. based on operant or cognitive-behaviour) usually inform the multi/inter-disciplinary rehabilitation interventions (Kerns et al., 2011; Scascighini, Toma, Dober-Spielmann, & Sprott, 2008; Turk & Okifuji, 2002). The main aim of psychological interventions is to increase the chronic pain patient's functioning (social, emotional and occupational) and to reinforce self-management, rather than alleviate pain (Roditi & Robinson, 2011; Sturgeon, 2014). Chronic pain patients who received treatment in multidisciplinary programmes based on CBT principles demonstrate better function than patients who received unimodal intervention (Kowal, Wilson, Geck, Henderson, & D'Eon et al., 2011).

Multi/inter-disciplinary intervention, based on biopsychological approach (e.g. Pain Management Programme), is recommended for the management of chronic pain

(SIGN, 2013). Evidence suggests that the multi/inter-disciplinary treatments are an effective approach to pain management (for meta-analyses see Cutler et al., 1994; Flor, Fydrich, & Turk, 1992; for reviews see Karjalainen et al., 2008; Scascighini et al., 2008).

In the following section, the theoretical framework of Behavioural Therapy (BT) is described as it informs the majority of contemporary psychological interventions in the management of chronic pain. Specifically, the underpinning theory and empirical support are reviewed.

2.7. Psychological Approach

Research has demonstrated that psychological interventions are essential for the management of chronic pain. Chronic pain is a subjective and emotional, but incurable, condition which affects all aspects of an individual's life. The role of the health psychologist in the context of chronic pain is to plan, implement and assess efficacious psychological interventions, so that individuals with chronic pain can have satisfactory lives, despite pain. In the following section, the major psychological behavioural approaches to the management of chronic pain are outlined.

2.7.1. Operant Behavioural Approach

One of the most important behavioural therapies for the management of chronic pain is the operant learning approach. Fordyce (1976), based on the major principle that behaviour is an outcome of learning, proposed the operant behavioural pain model, which states that pain behaviours can be affected or modulated by the consequences derived from the environment in which these pain behaviours are expressed, or take

place. The frequency of pain behaviours can be influenced positively or negatively by the consequences of these behaviours. Therefore, the environment can positively, or negatively, facilitate the production of certain behaviours which lead to prevention or exacerbation of pain-related disability. In particular, if pain behaviours such as grimacing or limping which express and communicate suffering, receive sympathetic responses from other people (for instance by making one exempt from daily responsibilities such as chores), this could lead to the maintenance of pain chronicity. By applying reinforcement principles, certain helpful behaviours (e.g. exercise) could be enhanced or unhelpful behaviours could be eliminated (e.g. excessive rest) (Day et al., 2012; Jensen, Nielson, & Kerns, 2003; Keefe et al., 2005; Kerns et al., 2011; Roditi & Robinson, 2011; Roelofs, Boissevain, Peter, de Jong, & Vlaeyen, 2002; Turk, 2003). Operant therapeutic techniques for reinforcing helpful behaviours comprise time-contingency medication control, activity pacing (splitting an activity in smaller more manageable parts) and graded activity (Gatzounis, Schrooten, Crombez, & Vlaeyen, 2012; Roditi & Robinson, 2011). Problem-solving and self-management techniques, plus occupational therapy and physiotherapy, could be incorporated into operant-based therapeutic interventions (Roelofs et al., 2002). Evidence supports the efficacy of the operant behavioural approach for the management of chronic pain (for reviews see Henschke et al., 2011; Tulder et al., 2000). In summary, evidence shows that it is important in pain management interventions to include operant techniques such as activity pacing, problem-solving and self-management training.

2.7.2. Cognitive-Behavioural Therapy

The acknowledgement of the role of cognitions leads to another biopsychosocial shift in the treatment of chronic pain (Day et al., 2012). Turk, Meichenbaum, & Genest (1983) proposed a cognitive-behavioural perspective on chronic pain, in which cognition, behaviour and emotion were interrelated. Cognitions play a central role in influencing behaviour (Turk et al., 1983). According to Turk (2002) the components of CBT intervention for chronic pain patients are:

- a) To enable patients to ‘reconceptualise’ their condition and symptoms as experiences they can change and manage (e.g. increase self-efficacy). This could be achieved through education. Specifically, educating a patient about how thought and emotion influence the pain experience (e.g. when stress is exacerbated and muscles become tense). Cognitive restructuring methods (e.g. diary-keeping) help patients to recognise, challenge and eventually modify unhelpful thoughts, behaviours and emotions.
- b) ‘Skill acquisition’ and c) ‘skills consolidation’ include a broad range of self-management techniques to facilitate control and management of factors which elicit distress and pain. Some of these techniques are problem solving, relaxation (muscle relaxation, breathing and biofeedback), attention diversion, communication skills, activity pacing and exercise.
- d) ‘Generalisation’ and ‘maintenance’ components aim to support and reinforce the maintenance of the newly acquired coping skills over time (e.g. set-back plan) (Turk, 2002).

In general, CBT interventions are structured and present-oriented, aiming to promote self-management, adaptive coping and functioning improvement rather than provide a cure for pain (Turk, 2003). Reduction of pain intensity could be achieved indirectly, by implementing behavioural and cognitive coping strategies and improving physical activity, which eventually lead to better functioning (Turk, 2003). CBT is an effective treatment approach for the management of chronic pain for both adults (for meta-analysis see Hofmann, Papas, Chatkoff, & Kerns, 2007; Morley, Eccleston, & Williams 1999; for review see Williams, Eccleston, & Morley, 2013) and children/adolescents (for review see Eccleston et al., 2013). CBT is considered the dominant framework in the context of pain management (Day et al., 2012; Pincus & McCracken, 2013).

As discussed previously, the ‘Fear-Avoidance’ Model (Vlaeyen et al., 1995; Vlaeyen et al., 1995; Vlaeyen & Linton, 2000) informs the design of pain-management interventions. The FA model is one specific variant of the CBT model; focusing on fear of pain and catastrophizing and explaining disability for those who exhibit phobia-avoidance pattern (Pincus & McCracken, 2013). Moreover, operant principles informed this model, as the interventions use graded exposure, and *in vivo* exposure techniques, in order to break the fear of pain, catastrophizing and avoidance pattern and to increase activity level in individuals (Kerns et al., 2011; Roditi & Robinson, 2011; Roelofs et al., 2002).

Vlaeyen, de Jong, Geilen, Heuts and Breukelen (2002) indicate that exposure to *in vivo* facilitates the reduction of pain catastrophizing, fear of pain and fear-of

movement/(re)injury. Exposure *in vivo* facilities consisted of educational sessions aimed at the notion that pain is not a serious disease but a common condition which can be self-manageable. Then, the fear-avoidance model is explained, based on chronic pain patients' beliefs, symptoms and behaviours. Afterwards, patients are encouraged to practice activities based on their graded hierarchy of situations that elicit fear. Patients are encouraged to engage in these activities until anxiety levels have been eliminated (Vlaeyen et al., 2002). Lindstrom et al. (1992) demonstrated that graded activity intervention facilitates lower back pain patients' return to their jobs earlier than participants in the control condition. Boersma et al. (2004) found that exposure to *in vivo* intervention facilitates resulted in the significant improvement in function and reduction of fear and avoidance. In conclusion, exposure to *in vivo* interventions can facilitate significant elimination of pain-related fear, catastrophizing, fear of movement and avoidance; in addition it also facilitates improvements in pain disability and severity (for reviews see Bailey, Carleton, Vlaeyen, & Asmundson, 2010; Lohnberg, 2007). In summary, it is important that pain management interventions fulfil two functions. First, they perform an educational function, in teaching individuals that pain is self-manageable condition. Second, they promote the production of beneficial behaviours by reinforcing engagement in physical activities which initially seems fearful. Consequently, continuous engagement with these activities leads to the reduction of pain-related fear and, as the FA model has demonstrated, can eliminate pain-related disability.

2.7.3. Acceptance Commitment Therapy

The 'third generation' of behavioural therapy is Acceptance Commitment Therapy (ACT) and mindfulness-based treatment, which focus on acceptance rather than

modification, and the elimination or control of negative thoughts and feelings and pain (Hofmann, Sawyer, Fang, 2010; McCracken, 2005). The aim of ACT is 'psychological flexibility' (to be consciously in the current moment, and preserve or alter behaviour according personal values) which can be achieved through core underlying treatment processes including: a) acceptance; b) cognitive-defusion; c) contact with the current moment; d) self as context; 5) values; and f) committed action (Hayes, Luoma, Bond, Masuda, & Lillis, 2006).

An ACT-based treatment in an inter-disciplinary hospital-based context for individuals that are severely disabled by chronic pain individuals has been shown to facilitate significant reductions in depression, physical and psychosocial disability, and frequency of GP visits and analgesic use (McCracken, Volwes, & Eccleston, 2005). Similarly, an ACT-based inter-disciplinary group treatment, concentrating on two core processes -acceptance and values- leads to significant reductions in pain-related anxiety, depression, disability and healthcare use, and leads to improvements in physical performance (Vowles & McCracken, 2008). A self-help book based on ACT has been shown to lead to significant improvements in acceptance, quality of life and satisfaction with life for individuals suffering from chronic pain (Johnston, Foster, Shennan, Srarkey, & Johnson, 2010). The ACT-based interventions have been shown to be effective on mental and physical health in individual living with chronic pain (for meta-analysis see Veehof, Oskam, Schreurs, & Bohlmeijer, 2011). ACT-based interventions are efficacious for the reduction of catastrophizing, fear of pain and fear of movement and for the improvement of pain disability and severity (for review see Bailey et al., 2010). Therefore, it is important to include techniques such as acceptance in pain management interventions.

So far, the importance of the biopsychosocial approach to the pain experience and its impact on individuals with chronic pain has been argued and a variety of treatments have been reviewed. Specifically, the theoretical underpinning framework and the empirical support of psychological therapies, within which a number of major elements of each therapy which appear to be important in any successful intervention (e.g. activity pacing, problem-solving, education, cognitive restructuring, relaxation, acceptance) have been presented. Even though all the psychological therapies which have been reviewed come under the umbrella of "behavioural therapies", the therapeutic elements of each psychological intervention are based on unique and distinct theoretical frameworks. Therefore, most of the evidence presented has included interventions with one or two of these elements. Such a multi-factorial approach is commonly utilised in many multi/inter-disciplinary programmes (Turk & Okifuji, 2002). However, these are often very expensive and difficult to access, especially for individuals living in remote areas (Carpenter, Stoner, Mundt & Stoelb, 2012; Sturgeon, 2014). Indeed, the majority of individuals living with chronic pain never get access to a specialised pain clinic (LeFort, Gray-Donald, Rowat, & Jeans, 1998; Smith, Chambers, & Smith, 1996); or there is a delay in receiving this type of treatment due to prolonged waiting list (Hogg, Gibson, Helou, DeGabriele, & Farrell, 2012). It is essential, therefore to explore alternative multi-factorial provisions/interventions for individuals living with chronic pain. One intervention currently in use in the NHS Lothian Chronic Pain Services in Edinburgh is the 'pain toolkit' website developed by a chronic pain sufferer, Pete Moore in collaboration with a GP, who is also Pain Rehabilitation Specialist and a Cognitive-Behavioural Therapist, Dr Frances Cole. This intervention comprises a variety of elements including

acceptance, activity pacing, relaxation, exercise, keeping a diary etc. While anecdotally the ‘pain toolkit’ appears to be effective and leads to improvements in terms of adjustment to life with pain; to our knowledge it has not yet been empirically tested. This current study sets out to establish the effectiveness of the ‘pain toolkit’ as a multi-factorial intervention for chronic pain. Among the proposed advantages of the ‘pain toolkit’ is that it is broadly accessible, as it can be delivered through the Internet and can be implemented without supervision. The intervention reinforces the self-management of chronic pain. As there is no cure for some individuals who live with chronic pain, the ability to self-manage it is essential. The literature supporting the benefits of self-management is discussed below.

2.8. Self-Management Approach

One of the main goals of psychological pain-management interventions is to help individuals with chronic pain to increase the self-management of their condition (Roditi & Robinson, 2011). However, the willingness or readiness to engage with a pain self-management intervention differs from individual to individual (this is explained below). Therefore, in the following section, readiness for pain self-management is reviewed in more depth. The underpinning theoretical framework of self-management, the empirical support for pain self-management interventions and the internet-based self-management interventions are reviewed in the subsequent sections.

2.8.1. Readiness of Self-Management

Psychological self-management interventions are essential, and research indicates that they are effective for the management of chronic pain. However, the willingness

to engage in self-management may differ across patients (Jensen, Nielson, Turner, Romano, & Hill, 2003). Jensen, Nielson and Kerns (2003) proposed a 'Motivational Model of Pain Self-Management' with the aim of understanding the willingness of people to engage in pain self-management. The significant underpinning mechanism is 'readiness' (see below Kerns, Rosenbergh, Jamison, Caudill, & Haythornthwaite, 1997) or motivation (used interchangeably), which is modifiable rather than stable. Therefore, this conceptualisation can facilitate the improvement of a patient's outcome. Readiness is influenced by self-efficacy beliefs (specifically an individual's belief that they are able to engage in pain self-management) and the belief that engagement with self-management is important (outcome expectancies) (Jensen Nielson & Kerns, 2003; Jensen, Nielson, Turner, Romano, & Hill, 2004).

Kerns et al. (1997), based on the transtheoretical model (Prochaska & DiClemente, 1984) and a cognitive-behavioural perspective on chronic pain (Turk et al., 1983), proposed that the differences in readiness to engage in a self-management approach could be understood in terms of stages of change. They developed the Pain Stages of Change Questionnaire (PSOCQ), in order to assess a patient's readiness to engage in a self-management approach. The stages are: a) precontemplation (includes beliefs that the management of pain can be achieved only by medical approaches and there is no willingness for engagement with a self-management approach); b) contemplation (includes beliefs that a self-management approach may be useful but there is resistant to giving up a medical pain management approach); c) action (includes not only a belief that a self-management approach is useful, but also attempts have been made to acquire self-management techniques) and; d) maintenance (includes the belief that a self-management approach has been applied).

Kerns and Rosenberg (2000) found that patients with chronic pain who successfully complete a CBT self-management intervention differed in PSOCQ score from those who did not complete the intervention. Interestingly, patients with chronic pain who held beliefs similar to the precontemplation stage were significantly less likely to complete the intervention while those who held beliefs similar to the contemplation stage were significantly more likely to complete the intervention. Similarly, Biller, Arstein, Caudill, Federman, and Guberman (2000) found that chronic pain patients with low levels of precontemplation, high levels of contemplation and action were more likely to complete a cognitive-behavioural pain management intervention. Carr, Moffet, Sharp, and Hines (2006) also found that participants with a high score on the contemplation scale were more likely to complete a pain self-management intervention.

Glenn and Burns (2003) found that, for chronic pain patients, a low pre-intervention score (as measured by PSOCQ) in precontemplation, a high score in contemplation and a high score in action, predicted better outcome improvements (responses to the treatment) than the opposite pattern of scoring in the stages. Moreover, they found that movement forward onto the next stage, following the engagement with the intervention, may reflect improvement in readiness to engage with the self-management approach and these changes may facilitate improvements in clinical outcomes.

Moreover, as multi-disciplinary pain programmes educate regarding the benefits of active coping strategies, and provide techniques for enhancement of self-efficacy for active coping with pain, at the end of the course of the intervention the readiness to engage with a self-management approach could increase (Jensen et al., 2004).

Specifically, Jensen et al., 2004 found that the precontemplation stage scores significantly reduced and the action and maintenance stage scores increased over the course of the intervention. Other studies have also found a similar pattern of change in scales of PSOCQ following pain management interventions (Kerns & Rosenbergh, 2000; Williams, Hapidou, Lin, & Abasi, 2007).

In summary, research has demonstrated that the PSOCQ is a useful tool which can predict self-management participation in a pain intervention. Moreover, the engagement with a pain intervention from onset to completion can facilitate improvement in the willingness to engage with a self-management approach toward pain. These changes can be detected by changes in PSOCQ scores. Thus, the PSOCQ has been utilised in the present study, in order to assess whether or not the readiness for pain self-management will increase following engagement with the pain self-management intervention.

2.8.2. Self-Management of Chronic Pain

As there is no cure for chronic pain, patients need to self-manage it in order to have as fulfilling a life as possible. However, there is no universal definition of self-management (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002). In literature, the terms ‘self-care’ and ‘self-management’ are usually differentiated (Clark et al., 1991) although the common aspect is the individual’s effort at self-treatment.

An individual’s ability to self-manage encompasses their management of the treatment, the symptoms, the psychosocial and physical consequences, the ability to monitor the condition and their own behavioural, cognitive and emotional responses to it, as well as the lifestyle changes which are affected by living with a chronic

condition (Barlow et al., 2002). Thus, self-management involves not only compliance with treatment, but also psychosocial management (Newman, Steed, & Mulligan, 2004). Aspects of self-management include: a) medical (e.g. by taking medication to manage the condition); b) role (e.g. reappraisal of social roles) and; c) emotional (e.g. reappraisal of future goals) management, aiming to enable an appropriate life (Corbin & Strauss, 1988 as cited in Lorig & Holman, 2003).

Effective self-management is developed collaboratively, when healthcare professionals provide appropriate information in order to ‘empower’ patients to manage their condition (Bodenheimer, Lorig, Holman, & Grumbach, 2002; DoH, 2005; Von Korff, Gruman, Schaefer, Curry, & Wagner, 1997). In the UK, NHS policies encourage a self-management approach (DoH, 2001, 2005). A good example is the ‘Expert Patient Programme’ (EPP) which includes self-management training sessions for people with a similar chronic condition, delivered by trained lay people with the same chronic condition (DoH, 2001). Programmes are supported by NHS healthcare professionals for the empowerment of patients (DoH, 2001, 2005).

The underpinning theoretical framework of self-management is based on Social-Cognitive Theory (Bandura, 1986), with self-efficacy as the major element (Clarl et al., 1991; Edworthy, 2000; Newman et al., 2004). Self-management interventions entail teaching patients new skills which promote self-efficacy and thereby enable them to implement these skills in the day to day management of their condition (Edworthy, 2000). Self-efficacy can be achieved/increases through verbal persuasion, personal achievement and observation of other people (Bandura, 1977). Programmes such as the EPP, delivered by lay-people with the same chronic condition as the participants, encourage the expert patients to act as role models for others (Foster et

al., 2009). Von Korff et al. (1998) indicate that self-management groups (which included action plans, setting goals, exercise and problem solving techniques) delivered by trained lay people with lower back pain are more efficacious than usual care, facilitate a reduction in worry and disability and boost a positive attitude and confidence in terms of self-management. In summary, these findings suggest that self-management interventions, delivered by lay people facilitating engagement with pain self-management lead to a reduction in the negative attitude and symptoms of fellow pain sufferers.

All the elements of increasing self-efficacy usually exist in pain-management cognitive-behavioural programmes (Nicholas, 2007). Pain self-management programmes are usually based on either CBT or incorporate cognitive-behavioural techniques (Jensen, Nielson, & Kerns, 2003). One of the main the goals of pain management programmes and CBT interventions is the self-management of chronic pain (Smith & Elliot, 2005). A brief CBT self-management intervention, including techniques such as exercising, stretching, setting goals, having a flare-up plan, activity pacing, challenging thoughts and desensitisation facilitates a reduction in fear-avoidance and catastrophizing beliefs and promotes pain self-efficacy (as measured by Pain Self-Efficacy questionnaire (PSEQ; Nicholas, 2007) (Nicholas et al., 2012). Gustavsson, Denison and von Koch (2011), found that a multimodal pain self-management intervention for individuals with chronic pain facilitated the improvement of self-efficacy, catastrophizing and coping with pain for up to two years.

Furthermore, important self-management skills include: problem-solving; the creation of collaborative relationship between patient and healthcare professional;

decision-making; usage of available resources and making action plan in order to accomplish goals (DoH, 2005; Lorig & Holman, 2003). The content of the current internet-based pain self-management intervention is designed to enable the individual suffering with chronic pain to acquire these important self-management skills. It reinforces the collaborative relationship between the chronic pain patient and the healthcare provider, directs individuals with chronic pain to the further resources available and encompasses various behavioural techniques for the development of decision-making and problem-solving skills.

These skills can be taught in a group or individual format in the community or hospital (Ersek, Turner, Cain & Kemp, 2008). Knowledge is an essential element of successful self-management, in order for patient to understand, for instance, the mechanism of the disease and/or how medication is working (Clark et al., 1991; Edworthy, 2000). Self-management education includes not only the acquisition of knowledge but also training in problem-solving techniques and increasing self-efficacy (Bodenheimer et al., 2002). Knowledge is also an important factor in the process of decision making (Lorig & Holman, 2003) and self-management (Taal, Rasker, & Wiegman, 1996).

Educational approaches are required which promote the development of coping and self-management skills, as CBT interventions and pain management programmes in primary care are not accessible for the increasing number of chronic pain patients (Smith & Elliot, 2005). One way to achieve this goal is through educational booklets (Smith & Elliot, 2005), since the goal of self-help materials is to increase patients' skills and knowledge in self-management (Williams & Whitfield, 2001). Self-help materials promote problem solving, skill development and self-management through

the utilisation of cognitive and behavioural principles (Buenaver, McGuire & Haythornthwaite, 2006). Interventions based on self-help materials that are delivered via books, the internet, telephone, audiotapes, groups and minimal contact formats are accessible to a larger number of chronic pain patients in a cost-effective way but the disadvantage of this method is the high levels of attrition that is observed (Buenaver et al., 2006). Furthermore, research demonstrates that cognitive-behavioural and brief educational interventions have been effective for the reduction of disability, which might be due to the elimination of pain catastrophizing and fear avoidance (Leeuw et al., 2007). Specifically, an educational intervention in primary care, which provides an educational handbook for chronic lower back pain patients, is likely to yield an improvement in participants' beliefs, in particular, and promote a reduction in fear avoidance beliefs which lead to improvement of disability (Burton, Waddell, Tillotson, & Summerton, 1999). A brief educational, self-care cognitive-behavioural intervention (supplemented by book and videos) facilitates the reduction of fear avoidance beliefs and worries about pain (Moore, Von Korff, Cherkin, Saunders, & Lorig, 2000). Moreover, an educational leaflet-based intervention (the content of the leaflet incorporates the principle of the fear avoidance model) facilitates the reduction of negative beliefs about lower back pain condition and days of absence of work (Symonds, Burton, Tillotson, & Main, 1995).

LeFort, et al. (1998) found that a group-based psychoeducational pain self-management programme facilitated an improvement in pain, self-efficacy and life-satisfaction for individuals with chronic pain. Moreover, according to Cole (1998) chronic pain patients who attended a psychoeducational self-management group-based programme (accompanied by a handbook for further engagement at home)

with an emphasis on learning coping skills such as relaxation, stress management, assertiveness training, and boosting self-esteem, showed a reduction in pain interference and intensity, depression and affective distress plus the improvement of general activity and sense of life-control. Furthermore, McGillion et al. (2008) found that a low-cost psychoeducational self-management programme including techniques to boost self-efficacy (e.g. modelling) and cognitive-behavioural self-management techniques, led to an improvement in health-related quality of life and self-efficacy for individuals with chronic cardiac pain. Accumulating evidence supports the idea that self-management educational interventions facilitate a modest reduction in disability and pain (see meta-analysis Warsi, LaValley, Wang, Avorn, & Solomon, 2003). Moreover, educational self-management interventions, carried out by lay-people, can lead to positive influences on health status and increased self-efficacy for self-managing conditions (for review see Foster et al., 2009).

In summary, a review of research literature shows that the content of self-management interventions can be diverse, including information about medication, symptom control, how to deal with the psychosocial consequences of the condition, communication, setting goals and accessing services for further support. Self-management interventions for conditions such as arthritis are multi-component and focus on symptoms management (e.g. pain), psychosocial management and lifestyle modifications affected by the nature of the condition. The underpinning theory can be based on social, cognitive and behavioural theories; for instance targeting the enhancement of self-efficacy. The mode of self-management interventions can be group, individual or a combination of both. The formats of delivery include lectures, booklets, audiotapes, the Internet, computer programmes, and role play, so patients

can engage either at home or in face-to-face sessions with healthcare providers (Barlow et al., 2002). Recently a novel approach to delivering pain self-management interventions via the Internet has been developed (Eccleston et al., 2014).

2.8.3. Internet-based Self-Management Psychological Interventions for Chronic Pain

There is restricted accessibility to multi-disciplinary pain treatments as the cost is high, the waiting lists are long and there is a lack of trained healthcare providers; this has led to the development of internet-based interventions (Carpenter, Stoner, Mundt, & Stoelb, 2012; Dear et al., 2013; El-Metwally, 2015; Keogh, Rosser, & Eccleston, 2010).

Internet-based interventions can enable and support chronic pain patients to engage in a self-management therapy and reduce their dependence on the healthcare clinics (Eccleston et al., 2014). Interventions delivered via the Internet can overcome the barriers of chronic pain for individuals who live in remote areas, work full-time or have difficulties leaving their homes due to disability (Berman, Iris, Bode, & Drengenberg, 2009; Ghalari, Packer, & Passmore, 2010).

The research evidence regarding the effectiveness of internet-based pain-management psychological interventions (e.g. CBT) for individuals with chronic pain is promising for individuals with chronic pain (e.g. for reviews see Bender, Radhakrishnan, Diorio, Englesakis, & Jadad, 2011; Eccleston et al., 2014). Specifically, the findings from a Randomized Control Trial (RCT) indicate that the engagement with internet-based self-management intervention increases knowledge about pain and pain management compared to waiting list control group. Moreover,

it leads to significant reduction in pain interference and severity, catastrophizing, perceived-disability, anxiety, stress, depression and pain-induced fear (Ruehlman, Karoly, & Enders, 2012). Berman et al. (2009) conducted a RCT and found that an internet-based self-management intervention, with email reminders, for older adults suffering from chronic pains led to improvements in terms of their confidence in engagement with self-care techniques, in order to manage pain and awareness of how to respond to pain in comparison with the waiting list group. Moreover, there was a significant reduction in pain interference and intensity for both groups. Williams et al. (2010) conducted a RCT and found that behavioural self-management intervention delivered via the Internet and incorporating CBT principles in educational self-help format, without professional feedback or contact, led to significant improvements in physical function and a reduction of pain for individuals with fibromyalgia compared to control group who receive standard care.

The utilisation of Smartphone technology is another way to deliver internet-based self-management interventions. Specifically, the results from an RCT indicates that a 4-week Smartphone-based intervention, including one face-to-face session, web-diaries and therapist feedback built on cognitive-behavioural principles, accompanied with self-management techniques (e.g. stretching, exercising, pleasurable activities and resting) increased acceptance and reduced catastrophizing in women with widespread chronic pain, compared to control group (Kristjansdottir et al., 2013). The findings from another RCT indicates that an internet-based intervention consisted of: a) a website that provided educational materials, target messages and automated goal setting; b) uploading pedometer and; c) an online support group, with

emails weekly reminders, reduced pain-related disability in the short-term compared to control group receiving standard care (Krein et al., 2013).

Moreover, CBT or ACT interventions via the Internet for various chronic pain conditions, with or without limited therapist feedback/support (e.g. telephone, email) and incorporating information about chronic pain and stress, relaxation, exercise/stretching, pacing, cognitive restructuring, sleep hygiene, mindfulness and a plan of maintenance, showed improvement quality of life, pain acceptance (pain willingness and activity engagement), ability to reduce and control pain and significant reduction in disability, depression, anxiety, catastrophizing, praying/hoping, diverting attention subscales of CSQ (Buhrman, Faltenhag, Strom, & Andersson, 2004; Burhram et al., 2013; Buhrman, Nielson-Iherfelt, Jannet, Storm, & Andersson, 2011; Buhrman, Skoglund, Hussell et al., 2013; Dear et al., 2013).

The findings from another RCT study indicates that an internet-based self-help intervention, based on a cognitive-behavioural theoretical framework (e.g. CBT & ACT) consisted of pain education, relaxation, mindfulness, behavioural activation based on values, stress management and cognitive restructuring components, facilitated the improvement of self-efficacy and a reduction in catastrophizing and fear of movement (avoidance) compared to waiting list control group (Carpenter et al., 2012).

PainACTION is an interactive website, based on self-management and CBT principles, which supports and reinforces active engagement with self-management activities. The website leads to significant improvement in coping in comparison with a control group, but not to improvements in self-efficacy or a reduction in pain

and psychological distress for patients with lower back pain (Chiauzzi et al., 2010). Another study using the same website facilitated a reduction in depression, stress, catastrophizing and improvements in headache self-efficacy, use of relaxation and social support for individuals with migraines (Bromberg et al., 2011). In a similar vein Trudeau et al. (2015) report that the same intervention for patients with arthritis pain facilitated an improvement in self-efficacy and a reduction in catastrophizing for at least 6 months. Another study, with individuals with arthritis pain utilising a different internet-based self-management intervention (ASMP: Arthritis Self-Management Programme) - based on self-efficacy theory (modelling, persuasion, skills mastery), facilitated a significant improvement in self-efficacy (Lorig, Ritter, Laurent, & Plant, 2008). Overall, research evidence shows that internet-based pain interventions can promote self-management and facilitate psychological and physical adjustment to pain for various types of chronic pain patients. Another internet-based pain self-management intervention is the 'pain toolkit' website that is relatively widely used with clinical population. However, it has never been empirically assessed using validated measurements. Addressing this gap is the overarching goal of this study.

2.9. Conclusion

Pain is a subjective and emotional experience. Not only physical but also psychosocial factors influence the experience of pain. Following the development of GCT and the establishment of the biopsychosocial approach, psychological factors have been recognised as being important elements which influence the experience of

pain. It is argued that a biopsychosocial perspective is important in order to understand and treat chronic pain. Some of the factors that influence (pain experience) the perception and adjustment to pain are self-efficacy, engagement with coping strategies, readiness to change, catastrophizing, pain-related anxiety and fear of movement (Keefe, 2004). The FA Model explains how psychological factors influence an individual's pain experience. Therefore, contemporary psychological interventions for management of chronic pain target these variables. As pain affects all aspects of an individual's life, an holistic perspective such as a multi/inter-disciplinary approach to management of chronic pain is most appropriate. Multi-factorial behavioural therapy usually informs multi/inter-disciplinary treatment. The aim of behavioural interventions is to promote better adjustment and self-management rather provide a cure for pain. Self-management is a major component of the experience of chronic pain as there is no cure and the individuals must learn to live with and manage their pain. A satisfactory life despite being in pain is influenced by the individuals' abilities to self-manage their pain. Thus, the development of effective pain self-management interventions is essential. However the accessibility of these self-management programmes is limited and Internet-based interventions can reduce some of the barriers of face-to-face or group-based interventions.

The primary aim of this study is, therefore, to examine the clinical effectiveness of an internet-based pain multi-factorial self-management intervention in a real-world clinical context. Research evidence indicates that some of the most important factors that influence the adjustment to chronic pain, such as self-efficacy, pain-related fear, catastrophizing, fear of movement/(re)injury, coping strategies and readiness of

engaging self-management were utilised as indicators of the effectiveness of the intervention.

The intervention is a well-known website known as the ‘pain toolkit’ and is in keeping with a self-management approach. Specifically, it provides psycho-educational skills, incorporating cognitive-behavioural techniques, such as acceptance, having an action plan, pacing, relaxation, stretching/exercise, keeping a diary, reinforcing a collaborative relationship with healthcare providers, shared decision making etc. The ‘pain toolkit’ website is considered to be a useful self-management intervention by various healthcare professionals, such as anaesthesiologists, nurses specialised in chronic pain, physiotherapists, health and clinical psychologists in the NHS Lothian Chronic Pain Services in Edinburgh; all of whom direct chronic pain service users to it (Personal Communication with Dr Wallace, Pain Management Programme, Astley Ainslie Hospital, Edinburgh). SIGN guidelines for the management of chronic pain also include it in the section on self-management tools (SIGN, 2013). Even though the ‘pain toolkit’ is considered to be a useful self-management intervention by many health care providers, to our knowledge there is no published study which assesses its effectiveness. The development of such an approach would be beneficial and cost effective for patients, healthcare professional and health services alike. In particular, such an intervention could be beneficial not only for people with chronic pain but also for individuals who have difficulty leaving home due to medical reasons. Moreover, further important benefits include the fact that the health care delivery becomes more effective, more time-efficient and there are less intensive deployment resources.

2.10. Aim and Hypothesis

The primary aim of this study was to examine the clinical effectiveness of the 'pain toolkit' website for chronic pain patients in a 'real world' clinical context. Specifically, to investigate whether there are changes in fear of movement/(re)injury, pain-related anxiety, catastrophizing, pain, coping strategies, self-efficacy and readiness of self-management.

Hypothesis 1: Participants' fear of movement/(re)injury, pain-related anxiety, pain catastrophizing, pain (intensity and interference) and passive coping strategies (i.e. diverting attention, catastrophizing, praying/hoping) will decrease after engagement with the 'pain toolkit' website.

Hypothesis 2: Participants' self-efficacy and active coping strategies (i.e. reinterpreting pain sensations, coping self-statements, ignoring pain sensations, increasing activity level, the ability to decrease and control pain) will increase after engagement with the 'pain toolkit' website.

Hypothesis 3: Participants' readiness to engage in pain self-management will increase from the onset to the completion of the intervention. Specifically, engagement with the 'pain toolkit' intervention will facilitate participants' movement into a more advanced stage of pain self-management.

3. Methodology

3.1. Introduction

This chapter outlines the procedures for addressing the hypotheses of the study. The settings where the recruitment was performed, along with the identification of the potential participants, the study design, material such as descriptions of the intervention and questionnaires, ethical considerations, recruitment procedures and sampling are outlined below:

3.2. Settings and Identification of potential participants

The recruitment was performed in two NHS Lothian hospitals, in Edinburgh.

3.2.1. Astley Ainslie Hospital (AAH)

Potential participants were identified from the waiting list for the Pain Management Programme. The recruitment process was started from a point where it was unlikely that the patient would be assessed for admission to the Pain Management Programme before the end of the research trial. Specifically, patients were approached who were identified as likely to remain on the waiting list for at least 8 weeks (the time required to complete the intervention plus the pre-and-post intervention questionnaires). At the time the study commenced, average time on the waiting list was 32 weeks.

3.2.2. Western General Hospital (WGH)

The potential participants from the WGH were chronic pain patients attending for a medical review with Consultants from the Pain Clinic and Rheumatology Unit.

Discharged chronic pain patients from the Rheumatology Unit were recruited as well.

3.3. Inclusion Criteria

Participants who were considered as potentially eligible were those chronic pain patients who had experienced pain for least for 6 months (Merskey & Bogduk, 1994) and met the following inclusion criteria:

- Aged over 18 years
- Referred by the Consultants
- Able to speak sufficient English in order to be able to understand printed material such as the Consent Form, Patient Information Sheet and Questionnaires
- Have Internet access

The aim of the study was to examine the effectiveness of the intervention in a ‘real-world’ clinical context. In particular, studies of the kind conducted here enable one to assess the effectiveness of the intervention in typical clinical contexts where the patient population is diverse (Patsopoulos, 2011) and, in this case, may include both individuals who have engaged with online interventions (as the ‘Pain Toolkit’, for example) as well as those who have not. Therefore, participants who had engaged with the intervention in the past were not excluded. It is considered that this decision was aligned with the principles of a ‘real-world’ clinical context.

3.4. Approach

Various methods were utilised in order to recruit potential participants from the different hospitals, taking into consideration the diverse functions of the clinics. In

all cases, the intervention was delivered by internet in participants' homes. Regarding the collection of the questionnaires, two different approaches were implemented in order to fit the functions of the different clinics. 1) Participants could return material by arranging a meeting with the researcher, either in the clinic or a home visit. 2) The collection of questionnaires was achieved without any face-to-face contact -with the participants returning completed questionnaires by post.

3.5. Study Design

To assess the effectiveness of the intervention, the study design utilised was a 'within subjects design' or 'repeated measure design'. This enables one to measure/detect changes 'within-person over time' (Guo, Logan, Glueck, & Muller, 2013) and usually requires a small sample size (Oberfeld & Franke, 2013; Shuttleworth, 2009). Moreover, participants act as their own control; in which way the impact of natural variation can be decreased among participants (Shuttleworth, 2009). The disadvantage of this design is the fatigue of participants to respond in multiple conditions (Shuttleworth, 2009). Thus a response burden is imposed on participants because they have to complete a series of questionnaires twice, in addition to completing the intervention itself. The decision to opt for this particular study design was taken, not only after considering the advantages of this design which were deemed appropriate for the examination of the effectiveness of the intervention in 'real-world' clinical context, but also due to pragmatic constraints. Specifically, there was a limited time-frame for the completion of the research. Randomized Control Trials and Between-Subject designs require more participants than Within-Subject designs. Thus, the recruitment period might be longer, making the completion of the study impossible.

3.6. Intervention

The internet-based intervention assessed in the study was the ‘pain toolkit located at www.paintoolkit.org. This provides psycho-educational skills and self-management training, incorporating cognitive and behavioural techniques, and directs sufferers to other resources which aim to encourage and help chronic pain sufferers self-manage their pain more effectively (Appendix 1). It was developed by Mr Peter Moore, a chronic pain patient, in conjunction with Dr Frances Cole -a GP who is also a Pain Rehabilitation Specialist and Cognitive Behavioural Therapist at West Yorkshire, Leeds Community Healthcare NHS Trust, to help with the self-management of this chronic health condition. It is available across the UK. The main content of ‘pain toolkit’ is described in the table 3.1.

Table 3.1	<i>The 12 tools of the ‘pain toolkit’ intervention</i>
Tool 1 Acceptance	Encourages acceptance of the long term nature of the patient’s incurable condition.
Tool 2 Get Involved- Building a support team	Encourages patients to develop a support team based on close relationships such as family, friends, work colleagues and health care professionals Encourages the development of self-management plan.
Tool 3 Pacing	Encourages the development and application of behavioural coping technique (e.g. by pacing daily activities such that they become more manageable).
Tool 4 Learn to prioritise & plan out your days	Encourages the prioritising and planning of daily activities.
Tool 5 Setting Goals & Action Plans	Encourages building an action plan when setting up personal goals.
Tool 6 Being patient	Encourages being patient with oneself. Encourages seeking help and support from others.
Tool 7 Relaxation	Encourages the practising of relaxation techniques.
Tool 8 Stretching & Exercise	Highlights the importance of practising stretching and exercise techniques.

Tool 9 Keep diary	Encourages the patients to keep a diary.
Tool 10 Set-back plan	Encourages the building of a set-back plan (e.g. seeking support from a member of the support team (Tool 2) when experiencing difficulty).
Tool 11 Team Work	Encourages the team work (e.g. collaboration with health care professionals).
Tool 12 Keep it up	Encourages the daily implementation of tools 1 to 11.

3.7. Questionnaires

Participants completed a battery of self-report questionnaires. The choice of this method was made as it is a time-effective method of data collection for a large number of people (Bechhofer & Paterson, 2000). Questionnaires can be administered either by face-to-face interview or by mail (Bechhofer & Paterson, 2000; Giuffre, 1997). However, the disadvantage of mailed questionnaires can be its low response rate (Giuffre, 1997). A detailed description of the pre-and-post intervention questionnaires is given below.

3.7.1. Demographic questionnaire (only in the pre-intervention pack of questionnaires)

A demographic questionnaire was created by the researcher (Appendix 2) in order to collect self-reported data on each participant's age, gender, marital status, employment status, length of pain, ethnicity, educational level, reading ability and quality of life. Participants were also asked to provide a written description for the questions concerning the type of chronic condition they had and whether they received any kind of psychological treatment. Moreover, participants were asked to respond either Yes or No to the questions of whether they considered the Internet to

be a useful resource to accessing information regarding their chronic condition, and if they had ever visited the ‘pain toolkit’ website.

The following standardised questionnaires were completed by participants before and after the intervention.

3.7.2. Pain Stage of Change Questionnaire (PSOCQ)

The Pain Stage of Change Questionnaire (PSOCQ) is a 30-item questionnaire developed by Kerns et al. (1997). It measures type of engagement with a self-management approach toward chronic pain (Appendix 3). It is the most widely used tool for assessing a patient’s readiness to engage in pain self-management. All the items in the questionnaire make use of a five-point Likert scale for responses, which ranges from 1 (strongly disagree) to 5 (strongly agree). PSOCQ includes four subscales: Precontemplation, Contemplation, Action and Maintenance. People in the precontemplation stage are characterized by a need to seek further medical treatment and no willingness to engage with a self-management approach toward pain. People in the contemplation stage are characterized by their willingness to consider the positive aspects of a self-management approach toward pain. People in the action stage are characterized by their use of active strategies to improve self-management skills. Finally, people in the maintenance stage are more confident about putting effort into sustaining their self-management skills over time (Kerns et al., 1997; Kerns & Rosenberg, 2000). Individuals are categorised in one stage based on their highest score on that subscale (Dijkstra, 2005; Habib, Morrissey, & Helms, 2003; Jensen, Nielson, Romano, Hill, & Turner, 2000; Strong, Westbury, Smith, McKenzie, & Ryan, 2002; Williams et al., 2007). In clinical populations, each scale

exhibits good internal consistency with Cronbach alpha coefficients of 0.77 (Precontemplation), 0.82 (Contemplation), 0.86 (Action), 0.86 (Maintenance) and adequate stability (0.74, 0.82, 0.76, and 0.88 respectively) (Kerns et al., 1997).

3.7.3. Tampa Scale for Kinesiophobia (TSK)

The Tampa Scale for Kinesiophobia (TSK: Miller et al., 1991; Vlaeyen et al., 1995) is a 17-item questionnaire that assesses the fear of movement and (re)injury in the individuals suffering from pain (Appendix 4). The TSK is considered the best available questionnaire to assess 'kinesiophobia' (fear of movement) (Lundberg et al., 2011). All the items within it make use of a four-point Likert scale for responses, ranging from 0 (strongly disagree) to 3 (strongly agree). The scores from questions 4, 8, 12 and 16 items must be inverted in order to calculate the total score, with higher scores indicating a greater fear of movement/(re)injury. Scores above and below 37 are considered as the cut-off scores of high and low fear of movement/(re)injury, respectively. The TSK has good reliability for chronic pain patients, with Cronbach alpha coefficient of $\alpha=0.77$ for the total scale (Vlaeyen et al., 1995) and test-retest stability 0.78 (Swinkels-Meewisse, Swinkels, Verbeek, Vlaeyen, & Oostendorp, 2003).

3.7.4. Pain Anxiety Symptoms Scale (PASS)

The short version of the Pain Anxiety Symptoms Scale (PASS-20: McCracken & Dhingra, 2002) is a 20-item questionnaire that assesses pain-related anxiety and fear (Appendix 5). PASS is considered to be the best available questionnaire for assessing pain-related fear and anxiety (Lundberg et al., 2011). All the items make use of a six-point Likert scale and responses range from 0 (never) to 5 (always). PASS includes

four subscales: (i) Cognitive anxiety; (ii) Fearful appraisal of pain; (iii) Escape/avoidance and; (iv) Physiological Arousal. The sum of each of the subscales (score ranges from 0 to 25) provides the total score of pain-related anxiety (the score ranges from 0 to 100), with higher scores indicating a greater pain-related anxiety. In clinical populations, PASS has shown good stability and reliability, with Cronbach alpha coefficients of 0.91 for the total scale and for each subscale 0.86, 0.82, 0.75 and 0.81 respectively (McCracken & Dhingra, 2001).

3.7.5. Brief Pain Inventory (Short- Form) (BPI)

The short form of the brief pain Inventory (SF-BPI: Cleeland & Ryan, 1994) is a 9-item questionnaire that assesses the intensity of pain (worst, least, average, right now) and its interference in an individual's life (general activity, mood, walking activity, normal work, relation with other people, sleep, enjoyment of life) (Appendix 6). The tool is recommended by SIGN (2013) for the management of chronic pain and IMMPACT (Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials; Dworkin et al., 2010). Specifically, SIGN and IMMPACT guidelines recommend that a numerical rating scale (0-10) is used to measure pain intensity and, secondly, that the BPI Interference scales are used to evaluate physical function (Dworkin et al., 2010; SIGN, 2013). The SF-BPI items make use of numeric rating scales (NRS) and responses, ranging from 0 (no pain) to 10 (pain as bad as you can imagine) for the severity of the pain and the degree to which the pain interferes with feelings, and activities in terms of daily function on a scale of from 0 (Does not interfere) to 10 (Completely interferes). The total severity score is calculated as the mean score of the four pain intensity items (worst, least, average, right now). The total interference score is calculated as the mean score of the seven interference items

(general activity, mood, walking activity, normal work, relations with other people, sleep, enjoyment of life). The internal consistency is good with Cronbach alpha coefficients of 0.80 to 0.87 for pain severity and 0.89 to 0.92 for pain interference (Cleeland & Ryan, 1994).

3.7.6. Pain Catastrophizing Scale (PCS)

The Pain Catastrophizing Scale (PSC: Sullivan, Bishop & Pivik, 1995) is a 13-item questionnaire that assesses the extent to which individuals experience catastrophic thoughts about pain and their aversive orientations toward it (Appendix 7). The PCS is the referent standard psychometric tool for measuring pain catastrophizing (Leung, 2012). All the items within the tool make use of a five-point Likert scale, with responses ranging from 0 (not at all) to 4 (all the time). It consists of three subscales: a) Rumination; b) Magnification and; c) Helplessness. The total score is calculated by adding the score of each of the thirteen items and ranges from 0 to 52; with a higher score indicating a higher level of catastrophizing. Scores above 24 and below 15 are considered to be cut-off scores of high and low catastrophizers respectively. The PCS has been shown to have from good to adequate internal consistency, with Cronbach alpha coefficients of 0.87 for the total scale and 0.87 for rumination, 0.66 for magnification and 0.78 for helplessness subscales and a test-retest stability 0.70 for a period of ten-weeks. The PCS is a valid and reliable measurement for both clinical and non-clinical populations (Sullivan, Bishop & Pivik, 1995).

3.7.7. Pain Self-Efficacy Questionnaire (PSEQ)

The Pain Self-Efficacy Questionnaire (PSEQ: Nicholas, 1989; Nicholas, 2007) is a 10-item questionnaire that assesses an individual's beliefs concerning whether or not

they are confident to carry out normal activities, despite the presence of pain (Appendix 8). The PSEQ is one of the most suitable tools for assessing self-efficacy in individuals living with chronic pain (Miles et al., 2011). All the items within tool make use of a seven-point Likert scale, with responses ranging from 0 (not at all confident) to 6 (completely confident). The total score is calculated by adding the score for each of the ten items and ranges from 0 to 60, with a higher score indicating stronger self-efficacy beliefs. Nicholas (2007), taking into account research evidence, indicated that a score lower than 17 on PSEQ meant that the individual believed that s/he needed to seek pain relief before becoming more active. Moreover, a score of over 40 on PSEQ means that the patient did not need a pain management programme. PSEQ has been shown to have good stability and reliability for chronic pain patients with Cronbach alpha coefficients 0.92 and good test-retest stability of 0.73 for a period of three-months (Nicholas, 2007).

3.7.8. Coping Strategies Questionnaire (CSQ)

The Coping Strategies Questionnaire (CSQ: Rosenstiel & Keefe, 1983) is a 44-item questionnaire that assesses the cognitive and behavioural coping strategies that an individual utilizes when experiencing pain (Appendix 9). It is the most widely used questionnaire of pain coping strategies (Tan et al., 2001). The first 42 items within it make use of a seven-point Likert scale, with responses ranging from 0 (never do) to 3 (sometimes do) up to 6 (always do that). The last two items assess the ability to control and reduce pain. Responses range from 0 (no control) to 3 (some control) up to 6 (complete control) and from 0 (can't decrease at all) to 3 (can decrease it somewhat) up to 6 (can decrease it completely), respectively.

CSQ includes six cognitive coping subscales: (i) Diverting attention; (ii) Reinterpreting the pain sensation; (iii) Ignoring sensations; (iv) Catastrophizing; (v) Coping self-statements, (vi) Praying or hoping; and one behavioural coping subscale: (vii) Increased behavioural activities. The total score for each subscale ranges from 0 to 36, with higher scores indicating a greater use of that strategy. The internal consistency of the subscales is satisfactory, with Cronbach alpha coefficients of 0.71 to 0.85 (Rosenstiel & Keefe, 1983).

3.7.9. Intervention Evaluation Questionnaire (only in the post-intervention pack of questionnaires).

An intervention evaluation questionnaire was developed by the researcher (Appendix 10) to evaluate participants' perceptions regarding the content of and satisfaction with, the intervention. It comprised: (a) close-ended questions, requiring participants to provide their evaluation on a five-point Likert scale, with responses ranging from 1 (strongly disagree) to 5 (strongly agree) and; (b) open-ended questions.

3.8. Ethical Considerations

Potential ethical issues that could arise from the research were addressed and considered before the commencement of recruitment. Throughout the design of the protocol, decisions were carried out in accordance with legal and ethical frameworks, such as the BPS Code of Ethics and Conduct (BPS, 2009), the HCPC Standards of Practice (SOP, 2009) and the NHS Ethics framework, to ensure safety of the participants.

Specifically, participants were protected by an honest and non-deceptive description of the research procedure. In accordance with research ethics guidelines, a clear and detailed Patient Information Sheet (PIS) was produced, written in plain language containing all the required and essential information, such as a clear explanation that participation in the study was entirely voluntary and that participants were free to withdraw from the research at any time without giving a reason. A minimum period of 24 hours was given to the participants in order for them to make a formal decision as to whether they wished to take part in the study. Following the participants' consent, a letter was sent to their GPs, which informed them of their patients' participation in the study (Appendix 11). Furthermore, a signed Consent Form (CF) was required for patients' inclusion in the study; an incomplete CF meant exclusion (Appendix 12).

To maintain confidentiality, the following procedures were undertaken: (a) all the information which was collected about the participants during the course of the research was securely stored, both electronically and physically; (b) participants' identities remained anonymous throughout the research process, as their questionnaire results were identified by a numerical code. Participants were fully informed in the Patient Information Sheet about the confidentiality procedures.

Although the intervention was delivered through the internet, paper-based questionnaires were selected as an appropriate method of data collection, instead of web-based questionnaires, in order to protect the participants from any kind of potential harm. Although web-based questionnaires are an easier way to collect data- due to the fact that the cost is low and the accessibility is high (Denscombe, 2006)- the confidentiality and anonymity of web-based questionnaires could be easier to

violate (Nosek, Banaji, & Greenwald, 2002) than would be the case with paper-based questionnaires.

3.8.1. NHS Ethical-Management Approval and Copyright permissions

Ethical approval for the study was granted by the South East Scotland Research Ethics Committee 01 (REC reference: 12/SS/0126) and Research and Development Office of NHS Lothian (R&D reference: 2012/P/PSY/14: Appendix 13) before data collection commenced. Copyright permissions, regarding the use of questionnaires was also obtained. Furthermore, the authors Mr Moore and Dr Cole also gave consent to use the Website for this study.

3.9. Recruitment procedures

The duration of the recruitment was from 4th September 2012 to 30th June 2014. Different procedures were implemented at the three clinics. These are outlined below:

3.9.1. Astley Ainslie Hospital

The office manager provided the names and contact details of potential participants from the waiting list for the Pain Management Programme to the researcher. An Invitation Letter (Appendix 14) was sent to potential participants from both the Head of Department and the researcher. The purpose of this Invitation Letter was for patients to consider whether or not they would like to participate in the study. Additionally, a phone call followed shortly afterwards, to discuss the study with them, provide an oral description of the study and to answer any questions they may

have had to help them decide if participation was right for them. Patients who expressed an interest in participating in the study were sent the Patient Information Sheet (PIS) (Appendix 15), Consent Form (CF) and a stamped, addressed envelope for return of the Consent Form. They were requested to study the PIS and to discuss the study with other people (such as their family, friends and the researcher). If they wished to participate in the study they were asked to return the signed CF. On receipt of the CF, the researcher posted a pack of questionnaires, a copy of the signed CF that contained both the researcher's and the participant's signatures and a stamped, addressed envelope for returning completed questionnaires. Participants were requested to complete and return the questionnaires during the following week. Once the completed questionnaires were returned to the researcher, the participants were directed to the website through the Intervention Letter (a letter describing the intervention: Appendix 16) and a six-week-period to explore and experience different self-management techniques was given. At the end of the six week intervention, the researcher sent participants the pack of post-intervention questionnaires and a stamped addressed envelope. Participants were requested to complete and return the questionnaires during the following week.

3.9.2. Western General Hospital

(I) Eligibility for participation was confirmed with the Consultant after a scheduled appointment with the Consultant for patients from the Pain Clinic and Rheumatic Diseases Unit

Patients were informed about the study by the Consultants from the Pain Clinic and/or the Rheumatology Clinic during their scheduled medical appointment. Patients who expressed interest were referred by the Consultant to the researcher.

The researcher provided an oral description of the study, and answered any prompt questions. Then, a package was given to those who expressed an interest in the study by the researcher. The package contained the PIS (Appendix 17), CF, Pre-Intervention Questionnaires, and a stamped, addressed envelope. In addition, the researcher asked potential participants if she could phone them, in order to confirm willingness to participate in the study and to answer any queries they might have regarding the study or completion of the questionnaires. If they wished to participate in the study, they were asked to return the signed CF and the completed pack of the questionnaires, either by post or by arranging a meeting with the researcher at their house or at the clinic.

For the intervention itself, and collection of the post-intervention questionnaires, the researcher followed the same procedures as described for the participants at AAH. In addition, during these stages the researcher phoned the participants to confirm arrangements for the return of the questionnaires and to address any queries they had regarding their completion.

(II) Eligibility for participation confirmed with the Consultant before a scheduled appointment with the Consultant for patients from the Pain Clinic

One week prior to their appointment with the Consultant, the individuals received, by post, the Invitation Letter (Appendix 18), the PIS (Appendix 19) and the CF, in order to have ample time to consider whether they would like to participate in the study. They were requested to complete the CF if they wished to participate in the research and bring it on the day of their scheduled appointment with the Consultant. On receipt of the CF, the researcher approached these individuals to provide an oral

description of the research study and to answer any questions. Regarding completion of the pre-intervention questionnaires, participants could complete the questionnaires while they were waiting to be seen by the Consultant, or shortly afterwards. Alternatively, they could return material either by post or by arranging a meeting with the researcher, as described above.

(III) Discharged Patients from the Rheumatic Diseases Unit

Consultants at the Rheumatology Clinic were able to provide a list of patients who had previously attended the Rheumatology Clinic, were diagnosed with chronic pain and subsequently discharged. These patients were sent an Invitation Letter, PIS (Appendix 20), CF, and a stamped, addressed envelope for return of the CF if they were willing to participate. Then, on the receipt of the CF, the researcher phoned these individuals to provide an oral description of the research and to answer any questions. Regarding the completion of questionnaires and intervention stages, the same procedure was followed as that described for the patients after a scheduled appointment with the Consultant.

3.10. Proposed Data Analysis

For the main analysis of the results regarding the first and second hypotheses, the ‘dependent t-test’ or ‘paired samples t-test’ was utilised in order to compare the participants’ mean scores before and after the intervention on each outcome measure. For the main analysis of the results regarding the third hypothesis, the Wilcoxon

signed-rank test was utilised in order to examine any changes in participant's stages before and after the intervention.

3.11. Sample

Before the commencement of the data collection, G* power software (Faul, Erdfelder, Buchner, & Lang, 2009; Faul, Erdfelder, Lang, & Buchner, 2007) was used to calculate the sample size, using statistical power 0.8 (80%) and an effect size of 0.3 (small). The program determined that a sample size of 90 participants minimum was needed (to allow for a 25% drop-out rate, the number increases for 120 participants). The number of participants required in order to achieve sufficient statistical power was also confirmed by the QMU statistician. However, this goal was not achieved at the end of the study.

As shown in Figure 3.1, by the end of the recruitment period 748 patients had been invited to participate in the research. Sixty-three participants were excluded (17 from the AAH and 46 from the Pain Clinic at WGH) as they did not meet the inclusion criteria (e.g. lack of Internet access or medical issues so serious that patients felt unable to participate in the research). The overall response rate (including patients from the two hospitals) was 26.7% with 183 patients signing the CF (out of the 685 eligible participants, specifically 188 from the AAH, 194 from the Rheumatic Diseases Unit and 303 from the Pain Clinic at WGH).

A higher response rate was achieved where face-to-face contact took place, in both cases at WGH, at the Pain Clinic (35.6% response rate with 303 patients invited of which 108 signed the CF) and the Rheumatic Diseases Unit (33.3% response rate

with 15 patients invited of which 5 signed the CF), respectively. This is in contrast to where the recruitment took place by letter. Here, the response rate was lower. Specifically, at the AAH (17.5% response rate with 188 patients invited of which 33 signed the CF) and for the Discharge patient from the Rheumatic Diseases Unit (20.4% response rate with 181 patients invited of which 37 signed the CF).

In total, 183 participants consented to take part in the research. Of this group, 143 participants completed the pre-intervention questionnaires. Out of the 143 participants only 48 participants completed the full protocol, comprising the pre-intervention questionnaires, the intervention and the post-intervention questionnaires. Ninety-five participants withdrew after the completion of pre-intervention questionnaires.

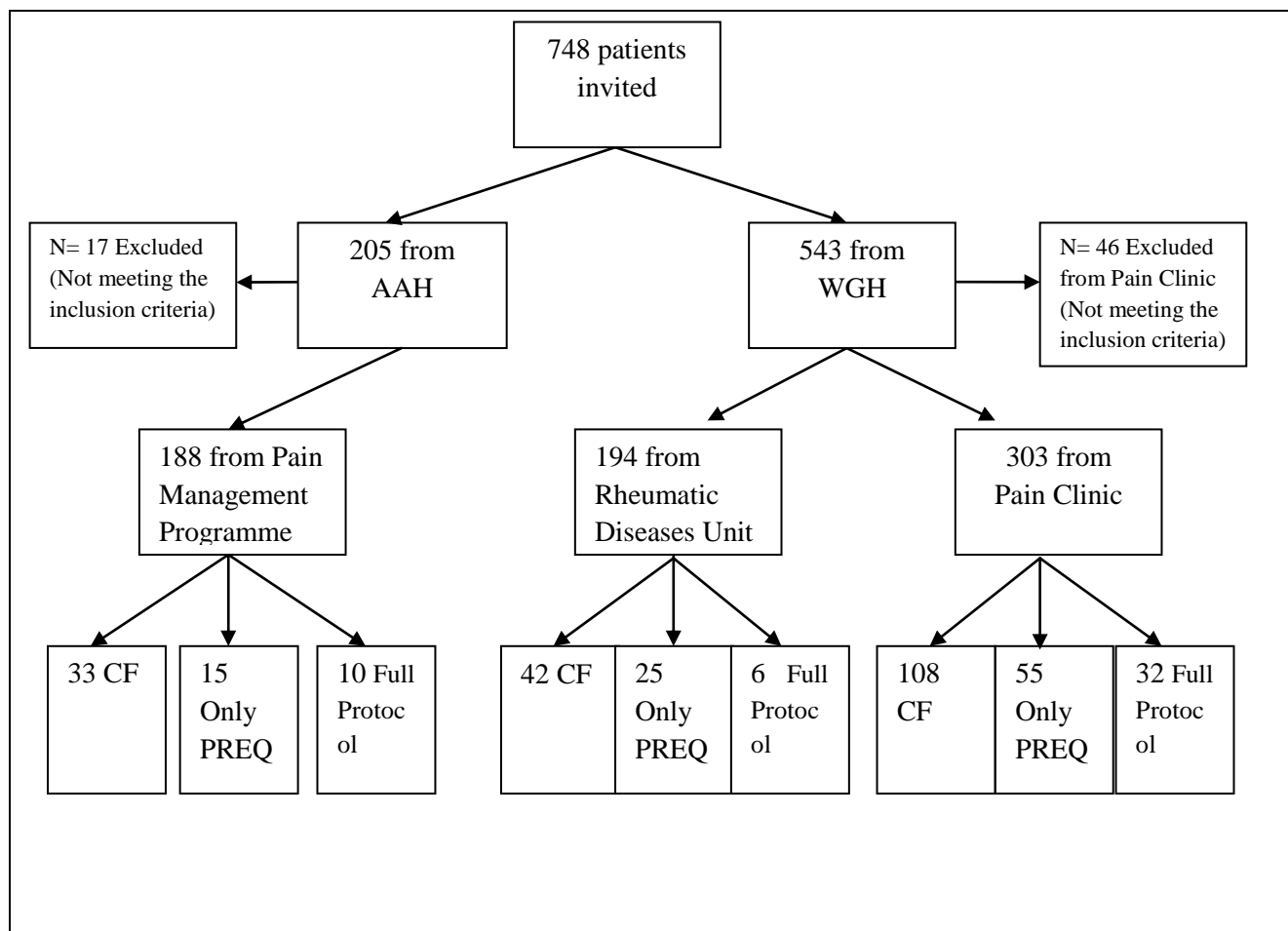


Figure 3.1. *Sampling flow diagram*

4. Results

4.1. Data Screening

Data analyses were performed using SPSS for Windows (version 21.0. Armonk, NY: IBM Corp.). Initially, data were screened for entry errors and missing values before to any analysis was conducted.

4.1.1. Missing Values

Where one or two items/questions in the multi-item questionnaire were missing, the score for the participant was adjusted from the questions answered to give a score out of all questions. Specifically, the equation $Y = (z \times N) / M$ was used, where z = score for questions answered, M = maximum score for number of question answered, N = maximum score for all questions, Y = score as if all questions had been answered. More than two missing items/questions in a multi-item questionnaire meant that the cases were excluded from the analysis (This procedure was adopted following personal communication with Dr Rush, QMU, Statistician). This approach resulted in overall variation across the total number of cases. In accordance with Tabachnick and Fidell (2007), prior to any analysis, data were examined for the assumptions of normality. The Shapiro-Wilk test was performed, as the sample size was not more than 50 participants (Razali & Wah, 2011) in order to examine the normality of the data distribution and to ensure the assumptions for parametric analysis. Where the Shapiro-Wilk test was significant, a non-parametric analysis for these variables was implemented.

4.2. Demographic Characteristics of the Sample

The total number of participants was 48. The sample consisted of 21 males (43.8%) and 27 females (56.3%) ranging between 22 and 77 years of age, with a mean age of 53.18 years (12.75 SD). Age distribution was normal. The majority of the sample were from the UK (N=46, 95.8%). Thirty-five participants (72.9%) were living with a partner (married or cohabiting) and 13 participants (27.1%) were living without partner (separated divorced, single, widowed). Twenty-one participants (43.8%) were employed (full-time, part-time, voluntary job), 17 participants (35.4%) did not work due to pain and 7 participants (14.6%) did not work for other reason than pain, such as being retired or a student. The majority of the sample, 29 participants (60.4%) had obtained a diploma or degree or professional qualification from college or university. Eighteen participants (37.5%) had secondary education (CSE, A Levels, CITY & GUILDS). Finally, only 1 participant (2.1%) did not have any type of formal education. The majority of the sample (N=47, 97.9%) rated that their reading ability and their comprehension level as good to excellent. Only one participant (2.1%) rated his/her reading ability as poor.

All participants had a diagnosed with a chronic painful condition. Specifically, 16 participants (33.3%) suffered from musculoskeletal disorders, 9 participants (18.8%) from neurological or neuropathic conditions, 6 participants (12.5%) from rheumatic conditions, 7 participants (14.6%) from various painful conditions such as migraine, multiple sclerosis or pelvic pain and 7 participants (14.6%) from chronic pain syndromes such as fibromyalgia. The length of experience of pain for 20 participants (41.7%) was from 7 months up to 3 years. The length of experience of pain for 16

participants (33.3%) was from 3 years to 10 years and 12 participants (25%) had been in pain for more than 10 years.

The majority of the individuals with chronic pain (N=43) took medication for the pain (91.5%). Of this group, 6 participants (12.8%) combined their medication with non-medical complementary therapies such as exercise, physiotherapy, reflexology or hydrotherapy. Two participants (4.3%) utilised only non-medical therapies such stretching, exercises and acupuncture for their pain. Finally, 2 participants (4.3%) did not administer any treatment or medication for their pain but one of them was prescribed painkillers which he was not taking at that time. Thirty-three participants (94.3%) did not receive any psychological treatment and only 2 participants (5.7%) reported that they had received psychological treatment.

In the demographic questionnaire, participants were asked to rate their quality of life on a Likert scale ranging from 0 (not fulfilling) to 10 (extremely fulfilling) (see Appendix 1). Twenty-two participants (45.8%) reported that their quality of life was low (range from 0 to 3). Eighteen participants (37.5%) indicated that their quality of life was moderate (range from 4 to 6). Only 8 participants (16.7%) reported that they had a high quality of life (range from 7 to 10).

Moreover, participants were asked to answer if they have ever visited the 'pain toolkit' website and whether they have ever used the Internet to access information about chronic pain. With regards to the intervention, 2 participants (5.6%) reported that they had come across the intervention. The majority of the sample (N=34, 94.4%) had not come across the intervention, even though, 14 participants (53.8%) had used the Internet to access information about support in dealing with their

chronic pain condition. Twelve participants (46.2%) had not used the Internet to access information regarding pain-management.

4.3. Baseline participants' characteristics

Scores below 15 and above 24 are considered to be cut-off scores for low and high levels of catastrophizing respectively (Sullivan et al., 1995). The mean score in this study was 22.69; indicating a moderate level of catastrophizing. Moreover, scores below 17 and above 40 are considered to be cut-off scores for low and high levels of pain self-efficacy, respectively (Nicholas, 2007). The mean score was 25.91; indicating a moderate level of self-efficacy.

The mean score for the total PASS score was 44.34; indicating a low-to-moderate level of pain-related anxiety as the potential maximum score is 100. The mean score of pain severity and interference were 5.95 and 6.61 respectively; indicating a moderate pain severity and interference, as the maximum score for each scale is 10. The maximum potential score for each coping subscale from the CSQ is 36. With the exception of 'coping self-statement' (mean score 18.95 indicating a moderate level), the other coping strategies included in this tool appear to be used infrequently. The means and the standard deviations of the pre-intervention variables questionnaires are demonstrated in the Table 4.1., below.

Table 4.1.
Descriptive statistics of the pre-intervention measures

Pre-intervention			
Measure	Mean	SD	N
TSK	21.92	6.74	47
PASS:	44.34	14.64	47
Cognitive Anxiety	16.31	5.08	47
Fearful appraisal	7.49	5.38	47
Avoidance	11.53	4.32	47
Physiological Arousal	9.00	5.11	47
BPI: Severity	5.95	1.69	48
BPI: Interference	6.61	2.19	48
PCS	22.69	12.42	46
Helplessness	10.80	6.55	46
Magnification	3.36	2.54	46
Rumination	8.52	4.80	46
PSEQ	25.91	14.79	47
CSQ:			
Diverting Attention	13.16	7.93	48
Reinterpreting Sens.	5.52	5.84	48
Catastrophizing	13.58	9.26	48
Ignoring Sensations	11.06	6.84	48
Pray/Hope	10.29	8.16	48
Coping Self-Statements	18.95	7.69	48
Increased Behavioural activity	15.10	6.41	48
Control over pain	2.45	1.55	48
Ability to decrease pain	1.85	1.18	48

Note: TSK: Tampa Scale of Kinesiophobia, PASS: Pain Anxiety Symptoms Scale, BPI: Brief Pain Inventory, PCS: Pain Catastrophizing Scale, PSEQ: Pain Self-Efficacy Questionnaire, CSQ: Coping Strategies Questionnaire

4.4. Assessment of the effectiveness of the intervention

It was hypothesised that the participants' fear of movement/(re)injury, pain-related anxiety, pain catastrophizing, pain (intensity and interference) and passive coping strategies (i.e. diverting attention, catastrophizing, praying/hoping) would decrease after engagement with the intervention. Moreover, it was hypothesised that the participants' self-efficacy and active coping strategies (i.e. reinterpreting pain

sensations, coping self-statements, ignoring pain sensations, increasing activity level, the ability to decrease pain and to control pain) would increase after engagement with the intervention. For the main analysis, a series of paired-sample t-tests (parametric test) and Wilcoxon signed-rank tests (non parametric tests) were conducted, to compare pre-intervention and post-intervention assessment outcomes. Findings are presented below:

4.4.1. Tampa Scale for Kinesiophobia (TSK)

There was a significant difference between the pre-intervention total score ($M=21.95$, $SD=6.81$) and the post-intervention total score for fear of movement/(re)injury ($M=20.21$, $SD=5.66$), $t(45)= 2.33$, $p=.024$. Following the intervention, the level of fear of movement/(re)injury was significantly lower.

4.4.2. Pain Anxiety Symptoms Scale (PASS)

There was a significant difference between the pre-intervention total score ($M=44.40$, $SD=14.95$) and the post-intervention total score for pain-related anxiety ($M=38.17$, $SD=14.35$), $t(44)=3.87$, $p<.001$. Following the intervention, the level of pain-related anxiety was significantly lower.

-Cognitive Anxiety

There was a significant difference between the pre-intervention total score ($M=16.33$, $SD=5.16$) and the post-intervention total score for pain-related Cognitive Anxiety subscale ($M=13.75$, $SD=5.60$), $t(44)=5.00$, $p<.001$. Following the intervention, the level of pain-related Cognitive Anxiety was significantly lower.

-Fearful appraisal of pain

There was a significant difference between the pre-intervention total score and the post-intervention total score for fearful appraisal of pain subscale $z = -2.25$, $p = .024$. Following the intervention, the level of fearful appraisal of pain was significantly lower.

-Escape/Avoidance

There was a significant difference between the pre-intervention total score ($M = 11.68$, $SD = 4.34$) and the post-intervention total score for the pain-related Escape/Avoidance subscale ($M = 10.31$, $SD = 4.20$), $t(44) = 2.09$, $p = .042$. Following the intervention, the level of pain-related Escape/Avoidance was significantly lower.

-Physiological arousal

There was no significant difference between the pre-intervention total score ($M = 8.93$, $SD = 5.18$) and the post-intervention total score for the physiological arousal subscale ($M = 8.25$, $SD = 5.29$), $t(44) = 1.22$, $p = .226$.

4.4.3. Brief Pain Inventory (Short- Form) (BPI)

-Pain severity

There was no significant difference between the pre-intervention total score ($M = 5.95$, $SD = 1.71$) and the post-intervention total score for the pain intensity subscale ($M = 5.69$, $SD = 1.97$), $t(46) = 1.36$, $p = .178$.

-Pain interference

There was no significant difference between the pre-intervention total score and the post-intervention total score for the pain interference subscale $z = -1.65$, $p = .098$.

4.4.4. Pain Catastrophizing Scale (PCS)

There was a significant difference between the pre-intervention total score ($M = 22.72$, $SD = 12.52$) and the post-intervention total score for catastrophizing ($M = 19.06$, $SD = 11.17$), $t(43) = 4.04$, $p < .001$. Following the intervention, the level of catastrophizing was significantly lower.

-Helplessness

There was a significant difference between the pre-intervention total score ($M = 10.88$, $SD = 6.57$) and the post-intervention total score for the helplessness subscale ($M = 9.63$, $SD = 5.84$), $t(43) = 2.83$, $p = .007$. Following the intervention, the level of helplessness was significantly lower.

-Rumination

There was a significant difference between the pre-intervention total score and the post-intervention total score for the rumination subscale $z = -3.42$, $p = .001$. Following the intervention, the level of rumination was significantly lower.

-Magnification

There was no significant difference between the pre-intervention total score and the post-intervention total score for the magnification subscale $z = -1.29$, $p = .196$.

4.4.5. Pain self-efficacy (PSEQ)

There was no significant difference between the pre-intervention total score ($M=25.91$, $SD=14.79$) and the post-intervention total score for pain self-efficacy ($M=26.37$, $SD=12.03$), $t(46) = -0.45$, $p = .653$.

4.4.6. Coping strategies Questionnaire (CSQ)

-Diverted Attention

There was no significant difference between the pre-intervention total scores ($M=12.75$, $SD=7.30$) and the post-intervention total score for the diverted attention subscale ($M=13.20$, $SD=7.69$), $t(44) = -0.43$, $p = .665$.

-Reinterpreting the pain sensations

There was no significant difference between the pre-intervention total score and the post-intervention total score for reinterpreting the pain sensations subscale $z = -1.60$, $p = .109$.

-Catastrophizing

There was no significant difference between the pre-intervention total score and the post-intervention total score for the catastrophizing subscale $z = -0.47$, $p = .634$.

-Ignoring Sensations

There was no significant difference between the pre-intervention total score and the post-intervention total score for the ignoring sensations subscale $z = -0.50$, $p = .613$.

-Praying/ hoping

There was no significant difference between the pre-intervention total score and the post-intervention total score for the praying/hoping subscale $z = -1.37, p = .170$.

-Coping self-statements

There was no significant difference between the pre-intervention total scores ($M = 18.95, SD = 7.88$) and the post-intervention total score for the coping self-statements subscale ($M = 18.73, SD = 7.30$), $t(44) = 0.27, p = .789$.

-Increases Behavioural Activity

There was no significant difference between the pre-intervention total score and the post-intervention total score for increases behavioural activity subscale $z = -0.35, p = .725$.

-Control over Pain

There was no significant difference between the pre-intervention total score and the post-intervention total score for the control pain subscale $z = -1.71, p = .087$.

-Ability to Decrease Pain

There was a significant difference between the pre-intervention total score and the post-intervention total score for ability to decrease pain subscale $z = -2.42, p = .015$. Following the intervention, the level of ability to decrease pain was significantly higher.

4.4.7. Pain Stages of Change Questionnaire (PSOCQ)

It was also hypothesised that the participants' readiness to pain self-management would increase from the onset to the completion of the intervention. Specifically, engagement with the intervention would facilitate participants' movement into next stage of the PSOCQ. Thus, participants were classified into a stage based on the higher PSOCQ score of that stage. In accordance with practice in previous research, in the cases that participant had the same score in two stages classified into the next higher stage between of the two stages (Williams et al., 2007). This happened for only one participant.

The number and percentage of participants within stages, for pre-intervention and post-intervention, are demonstrated in Table 4.2. Thus, change in participants' Pain of Stages of Chance Questionnaire, classification before and after the intervention can be observed ($n=47$). A Chi-square test for independence was performed and indicated that there was a significant association between stages before and after the intervention, $X^2(9, n=47) = 36,958, p= 0.000$. In other words, this indicated that the percentage in stages before and after intervention was significantly different. It must be noted that, due sample size, Chi square assumptions were not met.

Moreover, it could be seen that for those responses that were pre-contemplation stage, before intervention ($n=7$), 71.4% remained in same stage, whereas 28.6% of them moved forward to the contemplation stage. Also, for those responses that were in contemplation stage before the intervention ($n=22$), 31.8% remained in same stage, whereas 27.3% of them moved backward to the precontemplation stage and 40.9% moved forward to either the action or maintenance stages. Furthermore, for

those responses that were in the action stage before the intervention (n=2), all of them (100.0%) moved forward to the maintenance stage. Lastly, for those responses in the maintenance stage before the intervention (n=16), 6.3% moved backward to the contemplation stage, whereas the rest of them (93.8%) remained in the maintenance stage.

Table 4.2. *Change in Participants' Pain Stages of Change Questionnaire Classification before and after intervention (n = 47)*

		Post														
		Precontemplation			Contemplation			Action			Maintenance			Total		
		N	Row N %	N %	N	Row N %	N %	N	Row N %	N %	N	Row N %	N %	N	Row N %	N %
Pre	Precontemplation	5	71.4%	10.6%	2	28.6%	4.3%	0	0.0%	0.0%	0	0.0%	0.0%	7	100.0%	14.9%
	Contemplation	6	27.3%	12.8%	7	31.8%	14.9%	5	22.7%	10.6%	4	18.2%	8.5%	22	100.0%	46.8%
	Action	0	0.0%	0.0%	0	0.0%	0.0%	0	0.0%	0.0%	2	100.0%	4.3%	2	100.0%	4.3%
	Maintenance	0	0.0%	0.0%	1	6.3%	2.1%	0	0.0%	0.0%	15	93.8%	31.9%	16	100.0%	34.0%
	Total	11	23.4%	23.4%	10	21.3%	21.3%	5	10.6%	10.6%	21	44.7%	44.7%	47	100.0%	100.0%

Table 4.3. *Frequency and proportions of change in stages*

	Backward		Same		Forward	
	N	%	N	%	N	%
Precontemplation	n.a.	n.a.	5	71.4%	2	28.6%
Contemplation	6	27.3%	7	31.8%	9	40.9%
Action	0	0.0%	0	0.0%	2	100.0%
Maintenance	1	6.3%	15	93.8%	n.a.	n.a.
Total	7	14.9%	27	57.4%	13	27.7%

The frequency and proportions of change in stages are demonstrated in Table 4.3. It can be observed that the overall percentage of forward movement (27.7%) was larger than the overall percentage of backward movement (14.9%). On the other hand, the majority (57.4%) of participants stayed in same stage. A Wilcoxon Signed Ranks Test was performed to investigate any changes in stages from pre-intervention to post-intervention. There were no significant differences in stages following the intervention, $z = -1.536$, $p = .125$.

4.5. Summary of the main analyses

In the context of the three hypotheses that informed the analyses conducted here, the main findings are:

I) There were significant reductions in total score for fear of movement/(re)injury. There were also significant reductions in total score for pain-related anxiety plus cognitive anxiety, fearful appraisal of pain and escape/avoidance subscales but no significant differences for physiological arousal subscale. There were significant reductions in total score of catastrophizing plus rumination and helplessness subscales but no significant differences for the magnification subscale. There were no significant differences in pain (severity and interference) and in passive coping subscales.

II) There were no significant differences in total score of self-efficacy and active coping subscales. There was significant improvement in the ability to reduce pain.

III) There were no significant differences in pain stages following the intervention.

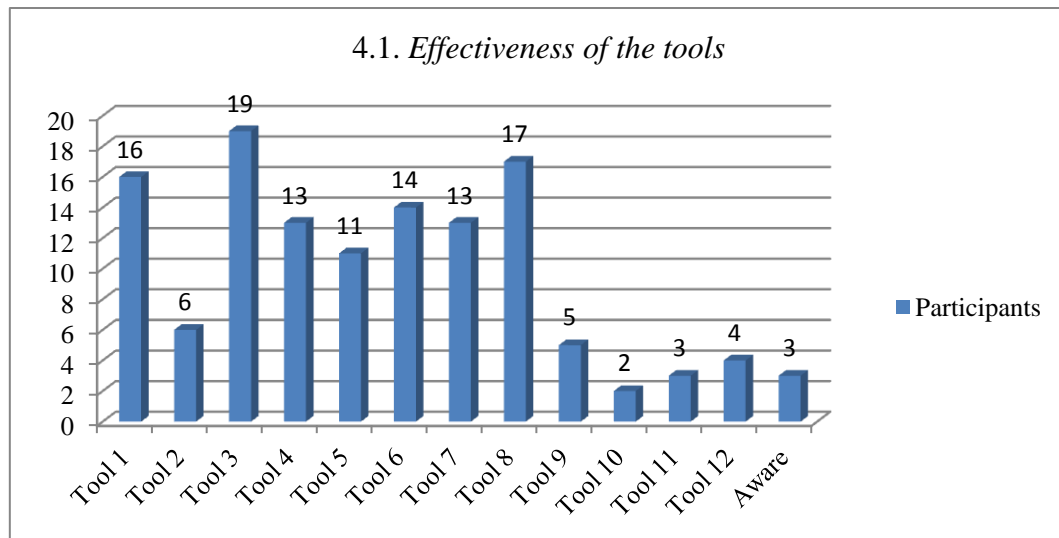
4.6. Evaluation of the intervention

As discussed in ‘Methodology’ section, at the conclusion of the intervention, participants were provided with an "evaluation of the intervention" questionnaire. The analysis described below is based on participants’ responses to one to nine questions. Questions 10, 11 and 12 were not included, as there were insufficient responses to draw any meaningful from the analysis.

Thirty participants (62.6%) rated the pain toolkit intervention from good to excellent. The majority of participants (N=38, 79.2%) indicated that the intervention was easy to read. Nineteen participants (39.6%) rated the information in the intervention as useful and 17 participants (35.4%) were neutral. Eleven participants (23%) indicated that the intervention facilitated the self-management of their chronic painful condition and 18 participants (37.5%) rated the intervention as neutral. The majority of the participants (N=26, 54.2%) did not use the intervention in partnership with their health care professionals. Only 6 participants (12.5%) used it in partnership with health care professionals. Moreover, 21 participants (43.8%) agreed that the intervention enabled them to get access to additional self-help information. Equally, 21 participants (43.8%) assessed the intervention as neutral for the access of extra self-help material.

For the question 7 ‘(name five tools that you found most useful in helping you to self-manage pain better’), as shown in Chart 1, 19 participants found Tool 3: ‘Pacing’ (Encourages the development and application of a behavioural coping technique, e.g. by pacing daily activities such that they become more manageable), 17 participants found Tool 8: ‘Stretching and Exercise’ (Highlights the importance of practising stretching and exercise techniques) and 16 participants found Tool 1: ‘Acceptance’ (Encourages acceptance of the long-term

nature of the patient's incurable condition) to be the most useful tools of the intervention in helping them to self-manage their pain more effectively.



For the question 8 ('name a tool that you found least useful in helping you to self-manage pain'), Tool 2: 'Get Involved, start building a support team' (Encourages patients to develop a support team based on close relationships such as family, friends, work colleagues and health care professionals. Encourages the development of a self-management plan) was assessed by the majority of participants (who responded to this question) (N=7, 22.6%) as the least useful tool of the intervention.

For the question 9 ('please indicate how many hours approximately you have spent on the website overall'), the results indicated that 31 participants (70.5%) engaged with the intervention for 1 to 6 hours. Five participants (11.4%) engaged with the intervention for 7 to 12 hours and 8 participants (18.2%) engaged with the intervention for more than 13 hours.

4.7. Investigating the relationship between demographic characteristics and pain intensity and interference

With the aim of examining whether the pain intensity and pain interference were influenced by the demographic characteristics of the sample, correlation analyses, for continuous variables, and an Independent samples T-Test, for categorical variables tests were performed. For these analyses, the total post-intervention score pain variables were subtracted from pre-intervention total scores pain variables. A new variable was created; thus the assessment of normality was performed. Pain interference was normally distributed (parametric analysis), whereas pain severity was no normally distributed (non parametric analysis).

4.7.1. Age (continuous variable)

A Pearson's correlation analysis was performed, to examine the relationship between age and pain interference. Findings indicated no significant association $r=-.122$, $n=47$, $p=.413$. A Spearman correlation analysis was conducted to examine the relationship between the age and pain severity. Again findings indicated no significant association $r=-.028$, $n=47$, $p=.850$.

4.7.2. Gender (categorical variable)

An Independent samples T-Test was performed for the pain interference in males and females. There were no significant difference for males ($M=0.38$, $SD=1.47$) and females ($M=0.40$, $SD=1.54$), $t(45)=0.04$, $p=.968$.

A Mann-Whitney U was conducted for the pain severity in males and females. Again, the results indicated no significant difference $U=265$, $p=.872$ between the sexes.

4.8. Completers vs. non-completers analysis for pre-intervention variables

Ninety-five participants completed the pre-intervention pack of questionnaires and then withdrew from the research (non-completers). Statistical comparison tests were conducted,

with the aim of examining whether any demographic characteristics distinguish the completers from non-completers groups. A Pearson Chi-Square of differences for demographic categorical variables (gender, education, employment and marital status) and an Independent samples t-test for the continuous variable of age, which was normally distributed, were performed to compare both groups.

There were no significant differences between completers and non-completers, as shown in Table 4.4. for gender ($p=.361$), marital status ($p=.195$) and employment status ($p=.930$). There were, however, significant differences between completers and non-completers with respect to educational background ($p<.001$). Significantly more of the completers had a higher education (including diplomas and degrees). Therefore, the educational background could be considered as an indicator of engagement with the intervention.

Table 4.4.

Demographic characteristics of completers and non-completers

Variable	Completers N=48		Non-completers N=95		P
	N	%	N	%	
Gender:					
Male	21	43.8	33	34.7	.361
Female	27	56.3	62	65.3	
Education:					
Higher	29	60.4	25	26.9	.000
Secondary	18	37.5	52	55.9	
None	1	2.1	16	17.2	
Marital Status:					
With Partner	35	72.9	57	61.3	.195
W/O partner	13	27.1	36	38.7	
Employment Status:					
Employed	21	46.7	44	47.8	.930
Not due to pain	17	37.8	32	34.8	
Not for other reason	7	15.6	16	17.4	
Continuous Variable	M=53.18	SD= 12.75	M=48.69	SD=13.32	.056
Age					

Moreover, with the aim of examining whether or not pre-intervention assessment measures distinguished completers from non-completers, further statistical comparison tests were performed. Prior to analyses, the data for non-completers were examined for assumptions of normality. The Kolmogorov-Smirnov test of normality was performed, as the sample was more than 50 participants. An Independent samples t-test (parametric test for normally distributed variables) and a Mann-Whitney test (non-parametric test for non-normally distributed variables) were performed for survey measures.

Results in Tables 4.5. (T-Test) and 4.6. (Mann Whitney) demonstrated that there were significant differences between completers and non-completers with respect to the catastrophizing total score ($p=.024$) and the two subscales of catastrophizing namely helplessness ($p=.011$) and magnification ($p=.044$). The non-completers had a significantly higher level of catastrophizing than the completers group. It is reasonable to speculate that the high level of catastrophizing might influence the high drop-out rate of the participants.

Table 4.5.

Pre-Intervention variables: completers and non-completers groups (Independent Samples T-Test)

Variable	Completers			Non-completers			P
	Mean	SD	N	Mean	SD	N	
TSK	21.92	6.74	47	24.42	8.95	91	.069
PASS	44.34	14.64	47	48.50	19.73	91	.164
Cognitive Anxiety	16.31	5.08	47	16.41	5.12	93	.918
Physiological Arousal	9.00	5.11	47	10.91	5.79	93	.057
BPI: Severity	5.95	1.69	48	6.04	1.60	89	.747
PCS Helplessness	10.80	6.55	46	13.69	6.08	95	.011*
PSEQ	25.91	14.79	47	27.40	14.24	92	.566
CSQ:							.556
Diverting Attention	13.16	7.93	48	12.29	8.39	88	

Ignoring Sensations	11.06	6.84	48	10.77	7.52	89	.826
Cop. Self-Statements	18.95	7.69	48	18.60	7.63	88	.796

Note TSK: Tampa Scale of Kinesiophobia, PASS: Pain Anxiety Symptoms Scale, BPI: Brief Pain Inventory, PCS: Pain Catastrophizing Scale, PSEQ: Pain Self-Efficacy Questionnaire, CSQ: Coping Strategies Questionnaire

Table 4.6.

Pre-Intervention variables: completers and non-completers groups (Mann Whitney U)

Variable	Completers		Non-completers		U	P
	N	Mean Rank	N	Mean Rank		
PASS:						
Fearful Appraisal	47	68.81	92	70.61	2106	.803
Avoidance	47	63.02	92	73.57	1834	.143
BPI:						
Severity	48	67.79	89	69.65	6199	.793
BPI: Interference	48	71.18	92	70.15	2175	.887
PCS: Total	46	59.88	95	76.38	1673	.024*
Magnification	46	61.11	95	75.79	1730	.044*
Rumination	46	63.25	95	74.75	1828	.116
CSQ:						
Reinterpreting Sensations	48	67.48	88	69.06	2063	.821
Catastrophizing	48	63.31	89	72.07	1863	.218
Pray/Hope	48	64.98	87	69.67	1943	.505
Increased Behavioural activity	48	70.59	89	68.14	2059	.730
Control over pain	48	68.31	91	70.89	2103	.707
Ability to decrease pain	48	57.89	91	76.39	1602	.108

Note: TSK: Tampa Scale of Kinesiophobia, PASS: Pain Anxiety Symptoms Scale, BPI: Brief Pain Inventory, PCS: Pain Catastrophizing Scale, PSEQ: Pain Self-Efficacy Questionnaire, CSQ: Coping Strategies Questionnaire

The number of completers and non-completers who were classified in the PSOCQ stages are demonstrated in Table 4.7. A Chi-square test for independence was performed and indicated no significant association between completers and non-completers, $X^2(3, n = 141) = 6.341, p$

= 0.096. In other words, this means that the percentages in stages for completers and non-completers were not statistically different. It must be noted that, based on their responses, the majority of both completers and non-completers were classified into the contemplation stage.

Table 4.7.

Number and percentage of completers & non-completers into stages

	Completers		Non-Completers	
	N	%	N	%
Pre-contemplation	7	14.6%	22	23.7%
Contemplation	22	45.8%	49	52.7%
Action	2	4.2%	6	6.5%
Maintenance	17	35.4%	16	17.2%
Total	48	100.0%	93	100.0%

In summary, the results indicated that, following the intervention, there were significant reductions in fear of movement/(re)injury, catastrophizing, pain-related anxiety and significant improvement in ability to reduce pain. The implications of the results are discussed further in the following section.

5. Discussion

The aim of this study was to assess the clinical effectiveness of an internet-based pain self-management website, the ‘pain toolkit’, for chronic pain patients in a ‘real-world’ clinical context. Specifically, the purpose of this study was to investigate whether the pain self-management internet-based multi-factorial intervention would have an effect on the patient’s fear of movement/(re)/injury, pain-related anxiety, catastrophizing, pain, coping strategies and self-efficacy. Moreover, the study was also intended to investigate whether the intervention would improve participants’ readiness to engage in pain self-management. Many patients are directed to the ‘pain toolkit’ website at the NHS Lothian Chronic Pain Services in Edinburgh because different healthcare professional consider the ‘pain toolkit’ to be an effective pain-management intervention. However, the effectiveness of this intervention has never been empirically assessed. To our knowledge, this is the first study to assess the effectiveness of the ‘pain toolkit’ in a clinical context.

This study had three hypotheses. It was hypothesised that the participants’ fear of movement/(re)injury, pain-related anxiety, pain catastrophizing, pain (intensity and interference) and passive coping strategies (i.e. diverting attention, catastrophizing, praying/hoping) would decrease after engagement with the ‘pain toolkit’ website. It was also hypothesised that the participants’ self-efficacy and active coping strategies (i.e. reinterpreting pain sensations, coping self-statements, ignoring pain sensations, increasing activity level, the ability to decrease pain and to control pain) would increase after engagement with the ‘pain toolkit’ website. Finally, it was hypothesised that the participants’ readiness to engage in pain self-management would increase from the onset to the completion of the intervention. Specifically, engagement with the ‘pain toolkit’ intervention would facilitate participants’ movement into a more advanced stage of pain self-management. With respect to the first hypothesis, significant reductions were noted in the patients’ fear of

movement/(re)injury, pain-related anxiety and catastrophizing. However, there were no significant reductions in pain and passive coping. With respect to the second hypothesis, there were no significant improvements in self-efficacy and active coping. There was, however, a significant improvement in participants' perception of their ability to decrease pain. With respect to the third hypothesis, there were no significant differences in changes of stages. Thus, following engagement with the intervention, participants' readiness to engage in pain self-management was not increased. Furthermore, results derived from 'evaluation questionnaire' (which was provided at the conclusion of the intervention) indicated that the majority of participants rated the intervention from 'good' to 'excellent' and found it easy to read.

In summary, the findings of the current study indicate that there were significant reductions in pain-related anxiety, catastrophizing, fear of movement/(re)injury and there was a significant improvement in ability to decrease pain. Accordingly, the findings of this study support the effectiveness of this internet-based pain self-management intervention, as improvement was observed in some important clinical outcomes. The implications of these findings are discussed below, with considerations of additional evidence and studies in related fields. To make these comparisons it is necessary to take into consideration the methodological and procedural differences between studies.

The findings of the present study are consistent with other internet-based pain-management interventions. However, the comparisons of clinical outcomes of this research with other internet-based interventions differ in some key aspects. Specifically, there was methodological and procedural diversity regarding the designs, intervention, delivery (with or without support), type of sample, measurements and data collection among the various internet-based pain-management interventions. In particular, the majority of studies were RCTs (e.g. Berman et al., 2009; Buhrman, Skoglund, Husell et al., 2013; Buhrman et al.,

2013; Buhrman et al., 2011; Carpenter et al., 2012; Chiauzzi et al., 2010; Kristjandottir et al., 2013; Ruehlman et al., 2012; Trudeau et al., 2015; Williams et al., 2010). Some of interventions were based purely on CBT or the ACT framework (e.g. Buhrman, Skoglund, Husell et al., 2013; Buhrman et al., 2013; Buhrman et al., 2011; Carpenter et al., 2012; Dear et al., 2013). Participants in some studies also had additional telephone support (e.g. Buhrman et al., 2004), encouragement or feedback (e.g. Buhrman, Skoglund, Husell et al., 2013; Buhrman et al., 2011; Dear et al., 2013) during their engagement with the intervention. Moreover, the sample consisted of a non-clinical population, as recruitment was through advertisements online and in the media (e.g. Buhrman et al., 2011; Buhrman et al., 2004; Carpenter et al., 2012; Ruehlman et al., 2012; Trudeau et al., 2015) and the data collection was performed via online questionnaires (e.g. Buhrman et al., 2004; Buhrman, Skoglund, Husell et al., 2013; Ruehlman et al., 2012). Studies further included just one type of chronic pain condition, such arthritis (e.g. Lorig et al., 2008; Trudeau et al., 2015), lower back pain (e.g. Carpender et al., 2012; Chiauzzi et al., 2010), migraine pain (e.g. Bromberg et al., 2011) and fibromyalgia (e.g. Williams et al., 2010).

The current study was performed in ‘real-world’ clinical context and participants were chronic pain patients with various types of chronic pain conditions. The study was of a within-subject design, without a control comparison group. The participants engaged in the intervention at their own pace in their own time, without any additional feedback or support. Data collection were performed by post. The internet-based pain self-management intervention in this current study was a multi-factorial psycho-educational, incorporating various cognitive and behavioural techniques. Specifically, some of cognitive and behavioural strategies, such as goal setting, communication skills training, relaxation, pacing and activity planning (Carpenter et al., 2012) are provided in the intervention. These

differences between studies are critical, since the different procedures may lead to different conclusions.

The ‘fear-avoidance’ model provides an explanation of how psychological factors (e.g. fear of movement) might influence the pain experience and maintain pain chronicity. Results of the current research indicate that the ‘pain toolkit’ intervention may facilitate reduction of some important clinical variables. Specifically, following the intervention there was a significant reduction in total score for fear of movement/(re)injury. This outcome is in line with previous RCTs, which administered CBT pain-management intervention via the Internet (e.g. Dear et al., 2013). Other RCTs which delivered internet-based interventions also found a significant reduction in fear avoidance beliefs measured by different tools (e.g. the Fear Avoidance Beliefs Questionnaire) (e.g. Carpenter et al., 2012; Ruehlman et al., 2012). Thus, the comparison with other studies suggests that the outcome of this present study is consistent with randomized control trials that had administered internet-based interventions with a purely CBT protocol.

Previous research indicates that educational interventions in booklet format can lead to the improvement of patients’ beliefs, such as fear avoidance (e.g. Burton et al., 1999) and avoidance behaviours such as prolonged work absenteeism (e.g. Symonds et al., 1995). Self-care group-based intervention, accompanied with educational materials, also facilitates also the reduction of fear-avoidance beliefs (e.g. Moore et al., 2000). This current study provides further evidence that a multi-factorial self-management internet-based intervention, delivered without any therapist support, can facilitate the reduction of fear of movement/(re)injury in various types of chronic pain patients. Moreover, the outcome of the present study, taking into consideration the outcome of the above studies, may lead us to draw the conclusion that, regarding the methods of delivery of a pain self-management intervention such as in the form

of a booklet or via the Internet both methods seem effective in facilitating the alleviation of fear-avoidance beliefs.

Moreover, there was a significant reduction in the total score for catastrophizing and the catastrophizing subscales ‘helplessness’ and ‘rumination’. On the other hand, with regard to the ‘magnification’ subscale, there was no significant difference. This is in line with RCTs, which had delivered internet-based pain management interventions, where pain catastrophizing was measured with the same tool (PCS) (e.g. Bromberg et al., 2011; Carpenter et al., 2012; Kristjansdottir et al., 2013; Trudeau et al., 2015). Similar findings, derived from a brief CBT group-based intervention, utilised self-management techniques such as pacing, stretching exercise, having a flare-up plan, challenging thoughts which lead to reduction of pain catastrophizing and fear avoidance beliefs (Nicholas et al., 2012). Thus, the current non-RCT study provides further evidence that a brief multi-factorial pain self-management internet-based intervention without therapist feedback might facilitate the reduction in pain catastrophizing in a similar way to CBT group-based interventions. The outcome of this current study also indicates that, for patients with various types of chronic pain, an internet-based pain self-management multi-factorial intervention may facilitate reduction in pain catastrophizing. The samples of other studies with reduction in pain catastrophizing, consisted of one type of chronic pain population such as migraine pain (e.g. Bromberg et al., 2011), lower back pain (e.g. Carpender et al., 2012) and arthritis (e.g. Trudeau et al., 2015).

There were significant reductions in the total score for pain-related anxiety and the ‘cognitive anxiety’, ‘fearful appraisal of pain’ and ‘escape/avoidance’ subscales. On the other hand, there was no significant reduction in the ‘physiological arousal’ subscale. Other internet-based ACT or CBT interventions for pain self-management found a significant reduction in anxiety (e.g. Buhrman, Skoglund, Husell et al., 2013; Dear et al., 2013; Ruhlman et al.,

2012). The majority of the studies previously undertaken assessed anxiety and depression in the context of psychological distress. This is the first study (that we are aware of) that assesses pain-related anxiety in the context of an internet-based pain self-management multi-factorial intervention. ACT-based interventions delivered in the format of groups have been shown to facilitate the reduction of pain-related anxiety (e.g. McCracken et al., 2005; Vowles & McCracken, 2008). Therefore, it can be considered that the outcome of the present study is comparable to other group-based pain-management interventions with a purely ACT framework, which seem also to facilitate the reduction in pain-related anxiety. The current study further adds to the existing literature in demonstrating that a pain self-management multi-factorial intervention delivered via the Internet can also effectively facilitate reduction of pain-related anxiety.

In summary, research has demonstrated that behavioural (e.g. ACT, CBT) and educational pain-management interventions delivered via the Internet, in the format of booklet, or group-based interventions facilitate the reduction of some important variables in pain experience such as fear of movement/(re)injury, catastrophizing and pain-related anxiety. Also, this current study shows that an internet-based multi-factorial self-management intervention, which can be delivered without any further support or feedback, may also facilitate a significant reduction of pain-related anxiety, catastrophizing and fear of movement/(re)injury for individuals with various types of chronic pain.

Regarding pain, there were no significant reductions in pain intensity and severity. One possible explanation of this outcome is that the duration of the intervention used here was only six weeks and there was no longer follow-up assessment. In this specific time frame it could be difficult to detect a significant reduction in pain. Further, Trudeau et al. (2015), also following an internet-based self-management intervention, found no significant reductions in pain intensity or interference either. They suggested that patients with arthritic pain may need

more than six months for changes in their level of catastrophizing and self-efficacy to sufficiently impact on their pain level. Furthermore, other internet-based self-management interventions which did show significant reductions in pain had follow-up assessments of the intervention after six months (e.g. Williams et al., 2010). In conclusion, further studies are needed, with follow-up after more than six weeks, in order to assess whether or not this particular intervention can facilitate reduction in pain.

Moreover, according to Buenavar et al (2006), self-help interventions facilitate pain reduction and disability through the enhancement of self-efficacy and this positive outcome could be sustained in the long-term. Following the intervention conducted here, there was no significant improvement in self-efficacy. This is another possible explanation for there being no significant reduction in pain following the intervention, as there was no significant improvement found in self-efficacy. The possible explanations where no significant improvements found in self-efficacy, are discussed below.

According to the literature review, one way of increasing self-efficacy is through modelling (i.e. observation of other people). Evidence supports the idea that educational self-management interventions, carried out by trained lay people (e.g. the Expert Patient Programme), can provide role models to participants, and have been shown to facilitate significant improvements in self-efficacy (Foster et al., 2009). The advantage of the 'pain toolkit' website is that one of the authors is a chronic pain patient. Therefore, it can be speculated that the author could act as a role model for the participants. One technique which increases self-efficacy is goal-setting (Reid et al., 2008); which is provided by the website (Tool 5: Setting goals and action plans). However, following the intervention there were no significant improvement found in self-efficacy. The reason for there not being a significant improvement in self-efficacy following the intervention is open to speculation. It may be that a time-frame longer than six weeks (the intervention duration) is essential in order for

participants to fully engage with the self-management techniques and feel more confident in the self-management of their pain. As there was no follow-up assessment (longer of six weeks), any longer term changes cannot be determined. Participants' baseline level of self-efficacy was moderate. Another possible explanation is that the way that the intervention had been delivered, specifically without support or feedback. This may be not enough to facilitate improvement in self-efficacy in participants with moderate level of self-efficacy as a baseline.

Interestingly, other internet-based pain self-management interventions with a randomised control study design have shown significant improvements in self-efficacy (e.g. Carpenter et al., 2012; Lorig et al., 2008; Trudeau et al., 2015). However, it is useful to note that the advertisement for participation in these studies was made via the Internet and flyers (e.g. Carpenter et al., 2012; Trudeau et al., 2015). So, it is reasonable to speculate that, as the recruitment did not take place in a clinical environment, the majority of the sample might suffer with milder pain conditions in comparison with the participants in this study who were recruited from a clinical population. Moreover, the theoretical framework of the internet-based studies with significant improvement in self-efficacy was based on CBT principles (e.g. Carpenter et al., 2012; Trudeau et al., 2015). Furthermore, the follow-up period was from 6 months (e.g. Trudeau et al., 2015) up to one year (e.g. Lorig et al., 2008) and for that reason, changes in self-efficacy might be more likely to be detected in this longer time-frame. On the other hand, Chiauzzi et al., (2010) found no significant improvement in self-efficacy following an internet-based self-management intervention for patients with chronic back pain. In summary, the findings of this study and the other internet-based pain-management interventions have demonstrated mixed results regarding the effect of internet-based interventions in self-efficacy. The reasons underlying this discrepancy are open to speculation. It may reflect the influence of different interventions, type of chronic pain

conditions, study design and duration of the interventions. More studies are needed taking into consideration the methodological and procedural diversity, in order to assess further the effect of internet-based pain self-management interventions on self-efficacy.

In addition, the study assessed whether the intervention might have an effect on coping strategies toward pain. There were no significant differences in the results from any of the subscales on the Coping Strategies Questionnaire (CSQ) but there was a significant improvement in the single item scale, the ability to decrease pain. Dear et al. (2013) found no significant differences between the control and CBT intervention groups in terms of coping. Trudeau et al (2015) interpreted a small impact on coping following an online self-management intervention for individuals with arthritis, by considering that, as the participants agreed to participate in a self-management study, this may be an indicator that they have already responded with active coping. Another possible explanation is that the content of the current intervention had been delivered in such way that may help participants to increase their knowledge about coping, but not to facilitate any changes in coping skills. Additionally, individuals with chronic pain may need more time than six weeks (duration of intervention) in order to fully engage and acquire the coping techniques presented to them in the intervention. In terms of follow-up, an assessment of longer of six week was lacking from this study so any potential changes in coping could not be detected. Further studies with longer follow-up are needed, in order to examine this possible explanation.

On the other hand, other internet-based studies have found a significant improvement in coping strategies. Specifically Chiauuzzi et al. (2010), following a self-management intervention based on principles of CBT for patients with chronic lower back pain, delivered online, found that it facilitated an increase in the use of active coping strategies, such as coping self-statements. Moreover, significant differences in coping were detected in 3-month and 6-month post-assessments. This positive result contradicts the outcome of the present

study, which found no significant differences in coping. Thus, it is reasonable to speculate, as mentioned above, that chronic pain patients may need longer than 6 weeks, (the duration of intervention and post-assessment period in this study) in order to change their coping strategies and for these changes to be detected.

Buhrman, Skoglund, Husell et al. (2013) found that in chronic pain patients following an ACT intervention, delivered via the Internet, there were significant reductions in the catastrophizing and praying/hoping subscales of CSQ. Similarly, a CBT self-help internet-based study, facilitated significant reductions in catastrophizing, and improvement in the ability to decrease pain and perceptions of control over pain (Buhrman et al., 2004). Buhrman et al. (2011), following an internet-based self-help management intervention based on a CBT model of chronic pain (Vlaeyen & Linton, 2000), found significant reductions in the catastrophizing subscale of CSQ in individuals with chronic pain. Finally, Buhrman et al. (2013) found that an internet-based CBT intervention facilitated significant reduction in the catastrophizing subscale of CSQ in chronic pain patients. In conclusion, CBT and ACT internet-based interventions tend to lead to the reduction of passive coping strategies and the improvement of active coping strategies. The ‘pain toolkit’ intervention seems to facilitate an improvement in the patient’s ability to decrease pain, which is in line with other internet-based CBT studies (e.g. Buhrman et al., 2004). This outcome furthered our learning that a multi-factorial pain self-management internet-based intervention can also have a positive impact on the ability to decrease pain in individuals living with various types of chronic pain.

Furthermore, it was hypothesised that the intervention would increase participants’ readiness to engage in pain self-management. However, the findings indicated no significant improvement in readiness to engage in pain self-management because, at the end of

intervention, participants' movement into the next stages of the PSOCQ was not achieved. This contrasts with other studies which, at the end of the intervention, participants moved forward into a higher stage of the PSOCQ (e.g. Williams et al., 2007). Further analyses were conducted in order to examine the differences in PSOCQ scores between completers and non-completers of the current study. The results indicate that there were no significant differences between completers and non-completers in relation to the precontemplation, contemplation, action or maintenance stages. This is in contrast with other studies, which found that the high levels in one stage might be an indicator of whether participants would complete the full protocol of the intervention. Specifically, chronic pain patients with high levels in precontemplation have been shown to be less likely to complete the intervention (e.g. Biller et al., 2000; Kerns & Rosenbergh, 2000) and high levels in contemplation have been shown more likely to complete the intervention (e.g. Biller et al., 2000; Carr et al., 2006; Kerns & Rosenbergh, 2000). However, the delivery of the interventions was not made via the Internet for the above studies, which found that the high level at one stage might be an indicator of successful or unsuccessful participation in the intervention. There are no studies that we are aware of, which examine the utility of the questionnaire in the context of internet-based pain self-management interventions. Therefore, it would be useful if further studies were conducted to investigate whether a high level at one stage before the engagement with the intervention can predict the successful completion of internet-based self-management interventions.

The outcome of this current study, based on comparison between completers and non-completers, brings into question the clinical utility of the PSOCQ. A high score in one stage might not always be a valid indicator of engagement with a pain self-management intervention. Thus, it is suggested that, in clinical contexts, the type of intervention that individuals need, based on their readiness to engage with a pain self-management

intervention, should not to be decided purely on the basis of their PSOCQ scores. This is further exemplified by the Habib et al. (2003) that suggested that the questionnaire lacks of sensitivity in order to be utilised for clinical decisions concerning the self-management intervention that individual need. The results of current study suggest that the higher score in one stage is not necessarily an indicator of the patient's readiness for engagement with a pain self-management intervention.

Furthermore, according to Jensen et al. (2000), an individual with chronic pain could be in the precontemplation stage for certain self-management behaviour (e.g. thinking that he/she is not able to increase physical activity) and at the same time be in the contemplation stage for another behaviour (e.g. thinking about eliminating the use of analgesics), as the pain self-management approach reflects various attitudes and behaviours. Thus, it is possible for the individual to be simultaneously in different stages for different self-management behaviours (Habib et al., 2003; Jensen et al., 2000). Individuals in the precontemplation stage may have a lower score for certain variables than individuals in the contemplation stage, but not in other (Dijkstra, 2005). It is not easy to determine whether a change in behaviour occurs in a continuum rather than or through stages (Ogden, 2007; Weinstein, Rothman, & Sutton, 1998). Jensen et al. (2000) supported the idea that readiness to engage with a pain self-management approach might be better understood as a continuum rather than stages for chronic pain individuals. Even though it is considered that individuals go through stages in a stable succession, it is possible for individuals to go backward and forwards again between the stages (Dijkstra, 2005). Moreover, the transition between stages can occur so quickly as to make the stages insignificant (Ogden, 2007; Weinstein et al., 1998).

It is essential to conduct further studies, taking into account that the theory of the stages of change in pain management should be developed further concerning the determinants of moving across the stages, the speed of change and the stability of the stages (Dijkstra, 2005).

It is also important that further studies are conducted in order to assess whether the individuals with chronic pain can be reliably classified into the PSCOQ stages (Williams et al., 2007).

In summary, findings from the current study have demonstrated that the intervention may facilitate significant reductions in fear of movement/(re)injury, catastrophizing, pain-related anxiety plus significant improvements in the ability to reduce pain. On the other hand, there were no significant improvements in self-efficacy, active coping and no significant reduction in levels of passive coping and pain. Also, following the intervention, participants' readiness to pain self-management was not increased. Overall, the current study has provided both clinical and research implications that have been discussed below.

5.1. Strengths of the Study

The study was performed in a real-world clinical context. Recruitment took place only in clinical settings; Astley Ainslie Hospital (AAH) and Western General Hospital (WGH), in NHS Lothian, in Edinburgh. Outpatients were recruited from secondary healthcare settings: a) the Pain Clinic (medical-based) and; b) the Rheumatic Diseases Unit at WGH. Participants were also recruited from the waiting list before their admission to the Pain Management Programme (psychological-based) at AAH, which is a tertiary setting. Discharged chronic pain patients from the Rheumatic Diseases Unit were also recruited. The sample of this study can be considered a heterogeneous 'real-world' sample, due to the fact that recruitment took place in various clinical settings.

Moreover, with the aim of assessing the effectiveness of intervention, there was no additional support or special strategy, such as emails or an online support group, to motivate the patients to participate in the study. There was no restriction on the application of the intervention. Participants engaged in the intervention in their own time, and at their own convenience and

pace. For the data collection, only questionnaires with established reliability and validity were used. The method of the data collection was by post rather than online, in order to protect participants' anonymity and ensure their safety. It was considered that the data collection by post was a safest choice regarding the protection of participants' data, in order to eliminate possible violation by a third party.

The sample were heterogeneous regarding gender, age, type of chronic pain and the length of experience of pain. There was no gender dominance. Other internet-based pain self-management interventions have had a dominance of females in their samples (e.g. Berman et al., 2009; Trudeau et al., 2015). The current sample consisted of various types of chronic pain conditions, such as musculoskeletal disorders, neurological and neuropathic conditions, rheumatic conditions and various painful conditions such as migraine, multiple sclerosis and chronic pain syndromes such as fibromyalgia. The length of pain varied, with participants having been in pain from 6 month to more than 10 years. As far as we are aware, this is the first study to assess the effectiveness of the intervention in a 'real-world' clinical context. The 'pain toolkit' appears to be helpful across a range of chronic pain conditions. However, due to the small size of the sample, the generalisability of the results to other chronic population is restricted.

5.2. Limitations of the Study

A major limitation of the study was its lack of control group, which is related to its within-subject design. A RCT is considered a robust study design in order to assess the effectiveness of intervention (Evans, 2003). However, the limitation of lack of a control group is counterbalanced, as participants are treated as their own control in 'within subject' design (Shuttleworth, 2009). Because this is first study to examine the effectiveness of this particular intervention, it was considered adequate to utilise a within subject design instead of RCT. In

addition, the lack of a long term follow-up assessment following conclusion of the intervention precludes knowing whether the positive outcomes remained over time.

One major limitation of this study was the small sample size ($n=48$). The sample was sufficient to yield adequate statistical power, but was still relatively small. The initial goal of sample size goal was not achieved; caused by the recruitment difficulties. Specifically, recruitment commenced from the waiting list patients for the Pain Management Programme at Astley Aislie Hospital. The number of potential participants was low at that time, as another researcher was recruiting participants from the same waiting list. Moreover, the number of patients referred by GPs to the clinic had also decreased. In addition, a major limitation of the study was the high dropout-rate, which further influenced the small sample size. Dropout rate is a major issue in clinical research generally (Glombiewski, Hartwich-Tersek, & Rief, 2010) and in psychological internet-based interventions can reach up to 83% (Melville, Casey, & Kavanagh, 2010). The reasons for drop-out rate in this current study were not officially tracked. However, the researcher contacted participants in order to confirm the arrangements for the return of questionnaires and the majority of participants who were unable to complete the full protocol mentioned that their main reason for withdraw was health issues. Family responsibilities, holidays and a change opinion regarding the willingness of participation in the study were other reasons for dropping out from the study.

Other studies of internet-based pain self-management interventions, with non-clinical samples advertised through the media had higher response rates that experienced here (e.g. Berman et al., 2009; Carpenter et al., 2012). A possible explanation is that participation in a study that has been advertised through media may be attractive for more motivated individuals, or those with fewer health issues than participants recruited from clinical settings. Moreover, individuals did not receive any financial incentive for participation in the study, in comparison to other internet-based self-management studies with lower dropout

rates (e.g. Berman et al., 2009; Carpenter et al., 2012; Ruehlman et al., 2012). In this study the recruitment was performed in clinical contexts (HCPC and BPS protocols were closely observed) where individuals might have more serious medical issues compared to studies with non-clinical population. Moreover, as the aim of the study was to assess the effectiveness of the intervention in clinical population, advertising through the media and with a financial incentive were not considered as appropriate recruitment strategies.

Even though internet-based interventions can be more convenient because participants can engage with them at home and in their own time, participation in the current study still required a high degree of commitment as participants had to complete pre-intervention and post-intervention questionnaires as well as engage with the intervention for six weeks. One of the limitations of Within-Subject design is participants' fatigue, caused by the requirement that they participate in the multiple study conditions (Shuttleworth, 2009). Therefore, this is might be another possible explanation for the high levels of drop-out rate that was observed. As individuals living with chronic pain usually not only have to deal with pain but also have to cope with complex medical conditions, it is reasonable to speculate that compliance with the required protocol of this study might have been difficult for some of the participants to follow.

The fact that the sample consisted of various types of chronic pain conditions can be considered an advantage, regarding the diversity of the sample. However, it was difficult to examine and conclude what types of chronic pain condition may benefit most from the intervention, due to small sample size (e.g. six participants with rheumatic pain, seven participants with various pain conditions such as pelvic pain, multiple sclerosis). Moreover, the small sample size made the comparison among the different settings where the recruitment was performed difficult (ten participants were recruited from AAH, six

participants were recruited from Rheumatic Diseases Unit and the majority of participants were recruited from WGH).

Another limitation with the sample was that the majority of the participants were from the UK. It is possible participants from UK have certain perspective regarding the healthcare system, psychological interventions, pain and self-management. Similarly, other internet-based pain intervention lacked cultural diversity, with predominantly Caucasian samples (e.g. Chiauzzi et al., 2010; Trudeau et al., 2015). It is possible that cultural characteristics might have influence the outcomes of the study. Therefore conclusions about the broader population must be drawn with caution.

It was difficult to control for confounding variables, as the study design was based in a ‘real-world’ clinical context. One major confounding variable was that the majority of participants received medication and two participants received psychological treatment. As there was no restriction on inclusion criteria regarding medication or psychological therapy, these participants were not excluded from the study. However, it is difficult to know whether the participants’ improvements have been as a result of either engagement with the intervention or from the additional treatment they had received.

Moreover, as was discussed in literature review, there is a conceptual differentiation regarding the pain catastrophizing variable. It was proposed that the catastrophizing be considered as an appraisal, specifically a distressing response toward pain rather than coping toward pain. Based on this differentiation, the current study considered catastrophizing and coping to be two distinct variables and, consequently, measured them with different questionnaires. The Pain Catastrophizing Scale (PCS: Sullivan et al., 1995) was utilised to measure pain catastrophizing in participants and was considered to be a more appropriate questionnaire due to the fact that it captured multiple dimension of catastrophizing such as

rumination, helplessness, and magnification, and it is considered the standard psychometric tool for assessing pain catastrophizing. The Coping Strategies Questionnaire (CSQ: Rosenstiel & Keefe, 1983) was utilised to assess coping strategies, as it is the most widely used questionnaire to assess coping in the context of chronic pain. However, catastrophizing is one subscale of CSQ. For the current study, it was considered that this subscale assessed coping responses toward pain. However, CSQ could be amended by excluding the catastrophizing subscale, for the purpose of the current study, in order to reduce the large number of questions that participants had to answer.

Internet-based interventions can increase accessibility and reduce some of the barriers of face-to-face interventions (e.g. transportation, cost). However, participants in this type of interventions must have Internet access and at least some type of computer skills (Macea, Gajos, Calil, & Fregni, 2010). Some of the participants who were invited and wanted to participate in the current study could not be included due to lack of Internet access. Moreover, in comparisons with individuals who did not complete all the phases of the study, the majority of ‘completers’ had obtained a higher education, from either university or college. The majority of participants who did not fully complete the study had secondary education. This finding is similar to the results of other studies of internet-based interventions (e.g. Lorig et al., 2008). Therefore, a lack of computer skills would prevent engagement with this type of intervention. Moreover, the current comparison between completers and non-completers indicated that participants who did not complete the full protocol of the study had higher levels of catastrophizing than completers. Internet-based self-management intervention may not be an optimal intervention for individuals with chronic pain and high levels of catastrophizing. Future studies may further examine this possible explanation. Future recommendations based on strength and limitations of the current study are discussed in the following section.

5.3. Study Implications

This is the first study (as we are aware of) to assess the effectiveness of the ‘pain toolkit’ website in "real-world" clinical context across range of chronic pain conditions and it extends our understanding of internet-based pain self-management interventions. Specifically, this study demonstrates the clinical and research relevance of an internet-based pain self-management multi-factorial psycho-educational intervention incorporating various cognitive and behavioural techniques. The ‘pain toolkit’ website provides various self-management techniques, such as behavioural (e.g. pacing), cognitive (e.g. acceptance), encourage/reinforce to increase activity (e.g. stretching, exercise) and self-efficacy (e.g. setting goals). The combined multi-factorial approach, without any support delivered in participants’ homes, seems to lead to promising outcomes. For individuals with various type of chronic pain conditions, engagement with the intervention seemed to alleviate some important variables such as catastrophizing, fear of movement/(re)injury and pain-related anxiety. In the evaluation questionnaire, the majority of the participants indicated that the evaluation was good and easy to read. Therefore, it is reasonable to speculate that participants were satisfied with the intervention. This study addressed the research gap of assessing the effectiveness of the ‘pain toolkit’ website in ‘real-world’ clinical context.

Furthermore, the availability of a multi-factorial pain-management treatment, such as multi/inter-disciplinary programmes is limited for the increasing number of chronic pain patients (Smith & Elliot, 2005). This current, albeit brief, multi-factorial self-management intervention seemed effective for the alleviation of some important clinical variables. Also, the Internet seems to be a promising alternative for delivering a pain self-management intervention to chronic pain patients from secondary or tertiary medical settings and for discharged patients as well. The format of delivery is a cost-effective and widely accessible way of delivering a pain self-management intervention. However, the heterogeneity of the

sample regarding the various types of chronic pain conditions and different durations of participants' experience of pain made it difficult to reach conclusions for specific sub-groups as the sample size was small, rendering comparisons among the different subgroups impossible. Therefore, the intervention may have a different impact on the diverse complex needs of various types of chronic pain patients. Nonetheless, this approach could be considered as either complementary or even a first line of treatment for any individual living with chronic pain. For instance, for patients in a waiting list on pain management programme. Moreover, health care professionals in primary care can direct patients to it as an early stage intervention. Without any cost and effort, individuals with chronic pain could be routinely directed to the website. This is consistent with SIGN's key recommendation for supported self-management (SIGN, 2013). This current study contributes both to research in the area and clinical practice in demonstrating the effectiveness of an internet-based multi-factorial pain self-management intervention for patients with chronic pain suffering from a range of conditions and from various medical settings.

5.4. Recommendations for Future Research and Clinical Practice

As discussed in the 'study implications' section, this study further adds to our existing knowledge concerning the effectiveness of internet-based pain self-management interventions. Therefore, additional studies must be conducted, with other types of chronic pain conditions and different medical settings, in order to further examine the effectiveness of this intervention. Future studies are needed, taking into consideration the strengths and limitation of this study, in order to further expand our understanding of this type of intervention.

Specifically, replication with a larger sample size is essential, in order to allow comparison between different types of chronic pain conditions. Moreover, even though there was no

restrictive inclusion criteria about malignant pain, the sample consisted of patients with chronic non-malignant pain, except for one participant in the non-completers group, who had breast cancer. Future studies may be helpful in order to examine whether the intervention can have a positive outcome for participants with malignant pain.

Further studies could also be conducted and recruit participants from different clinical settings, such as primary care. Or, to replicate the recruitment from the same settings as that conducted for this current study but with larger sample size- to allow a comparison between them. Follow-up assessment is essential, to examine whether the positive changes that were observed remained over time.

Furthermore, individuals with chronic pain have heterogenous and complex needs, as pain influences all aspects of their lives. It is essential to investigate further what type of multi-factorial pain self-management interventions are most effective for individuals with different types of chronic pain and how this type of interventions can generate positive outcome. Comparison of the intervention with other multi-factorial interventions which include different techniques (e.g. contact with the present moment, mindfulness) would also generate useful conclusions. Moreover, future studies may take into account the fact that individuals with different types of chronic pain conditions may require different types of interventions. Initially, it would be helpful to assess the needs of individuals. Then, based on these individuals' particular characteristics and needs, to develop multi-factorial pain self-management interventions that are individually tailored. In this way, the effectiveness of different multi-factorial interventions for individuals with various types of chronic pain can be examined. Different multi-factorial internet-based interventions based on individuals' needs may expand our understanding of the effectiveness of this type of pain self-management.

It is still unknown who benefits the most from interventions delivered via the Internet (Carpenter et al., 2012). The content of the 'pain toolkit' is also available in the format of a booklet. Therefore, a study examining different methods of delivery of pain self-management interventions could provide insight into whether the mode of delivery is related to any differences in outcome. For instance, one group would receive the 'pain toolkit' in the format of a booklet and another group would access the 'pain toolkit' website. In this way, a deeper understanding of who benefits more from the internet-based intervention, and the barriers to engagement with intervention presented in this manner, could be examined further. Also, it would be helpful to include an objective measurement of disability in future studies, which was lacking from this study, in order to examine further whether levels of disability might influence patient engagement with an internet-based pain self-management intervention. Moreover, to also assess whether the intervention may influence the individuals' level disability.

Chronic pain influences individuals' quality of life. In the demographic questionnaire there was a single question that assessed participants' current quality of life, with the purpose of gathering information regarding their current status. Future studies could include validated and reliable QoL questionnaires, in order to assess whether the intervention may have an effect on this. Moreover, individuals living with chronic pain frequently experience symptoms of depression (Bair, Robinson, Katon, & Kroenke, 2003; Tunks et al., 2008). It would be helpful for future studies to include valid assessment of an individual's level of depression, in order to evaluate whether the intervention can have an effect on depression as well. Additional indicators of treatment outcomes, such as analgesic consumption, healthcare utilisation and return to work would be considered as more objective outcomes concerning the effectiveness of the intervention (McCracken & Turk, 2002).

Moreover, in the current study, different recruitment procedures were performed in order to cover the different function of the clinics. It was observed that a higher response rate was achieved in recruitment with face-to-face contact and it would be interesting to examine in future studies whether different recruitment procedures might lead to different response rate. Internet-based intervention is a new, growing, cost-effective way of delivering pain self-management interventions. Assessment of patients' satisfaction with the Internet-based intervention is useful, in order for more appealing protocols to be developed in the future. Data regarding the cost-effectiveness of the internet-based intervention must also be considered for collection.

Possible use of the intervention in clinical practice might include the following: For successful self-management, individuals need to acquire certain skills, such as problem solving and the ability to work in collaboration with healthcare professionals. The 'pain toolkit' website can be used in collaboration with healthcare providers. Patients can engage with the website and then indicate to healthcare providers the areas and skills that they need to apply and develop further. Then, based on patients' needs, healthcare providers, can impart more information, or even more materials (e.g. relaxation leaflets, self-help booklets, websites), support or explanations of how to apply self-management techniques in their patients' daily lives, in order to help them to achieve their personal self-management goals. The website could be a useful guide for the individual to facilitate the acquisition of the appropriate skills for successful self-management, in collaboration with their healthcare providers.

Moreover, the intervention might be a useful additional pain self-management intervention, following the completion of inter/multi-disciplinary interventions such as those provided by pain management programmes because it summarises the various cognitive and behavioural techniques that the patients have already been taught, learned, practised and utilised.

Therefore, it may be a useful tool for prevent relapse, as the continuous practice of these techniques may facilitate sustaining the positive outcomes of pain management programmes.

5.5. Conclusion

The purpose of this study was to assess the effectiveness of the ‘pain toolkit’ website. This study contributes to existing evidence concerning the effectiveness of a pain self-management internet-based intervention in improving chronic pain patients’ well-being. Overall, the results demonstrate that a pain self-management internet-based multi-factorial psycho-education intervention which incorporates various cognitive and behavioural techniques, facilitates a significant reduction of fear of movement/(re)injury, pain catastrophizing, pain-related anxiety and improvement in ability to decrease pain for individuals living with various types of chronic pain. The method of delivery of the self-management intervention, which is via the Internet, implies that it is a helpful tool for the management of chronic pain. However, participants with a high level of education and low levels of catastrophizing are more likely to engage with, and benefit from, this type of intervention. Therefore, it is reasonable to speculate that internet-based pain self-management interventions are only suitable for certain group of individuals. The ‘pain toolkit’ website seems to be a useful pain self-management intervention. However, it is essential that more studies are conducted in order for the positive outcomes of this current work to be further explored and confirmed.

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Appendices:

Appendix 1:

Intervention

Appendix 2:

Demographic questionnaire

Appendix 3:

Pain Stage of Change Questionnaire (PSOCQ)

Appendix 4:

Tampa Scale for Kinesiophobia (TSK)

Appendix 5:

Pain Anxiety Symptoms Scale (PASS)

Appendix 6:

Brief Pain Inventory (Short- Form) (BPI)

Appendix 7:

The Pain Catastrophizing Scale (PSC)

Appendix 8:

Pain Self-Efficacy Questionnaire (PSEQ)

Appendix 9:

Coping Strategies Questionnaire (CSQ)

Appendix 10:

Intervention Evaluation Questionnaire

Appendix 11:

GP Letter

Appendix 12:

Consent Form

Appendix 13:

R&D and NHS Ethical Approval

Appendix 14:

Invitation Letter, Astley Ainslie Hospital

Appendix 15:

Patient Information Sheet, Astley Ainslie Hospital

Appendix 16:

Intervention Letter

Appendix 17:

Patient Information Sheet, After Scheduled Appointment, Western General Hospital

Appendix 18:

Invitation Letter, Western General Hospital

Appendix 19:

Patient Information Sheet, Before Scheduled Appointment, Western General Hospital

Appendix 20:

Patient Information Sheet, Discharged Patients, Western General Hospital